CALIFORNIA HIGH-SPEED TRAIN PROGRAM EIR/EIS

Task 2.3.1R

BAY AREA-TO-MERCED CORRIDOR HIGH-SPEED TRAIN ALIGNMENTS/STATIONS SCREENING EVALUATION

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ACRONYMS

ACE	Altamont Commuter Express
ABAG	Association of Bay Area Governments
Authority	California High-Speed Rail Authority
BART	Bay Area Rapid Transit District
CEQA	California Environmental Quality Act
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
FRA	Federal Railroad Administration
JPB	Peninsula Commute Joint Powers Board
maglev	magnetic levitation
MTC	Metropolitan Transportation Commission
ROW	Right-of-way
SFIA	San Francisco International Airport
SR	State Route
UPRR	Union Pacific Railroad
VTA	Santa Clara Valley Transportation Authority

S.0 SUMMARY

Following adoption of a Final Business Plan[1] in 2000, the California High-Speed Rail Authority (Authority) recommended that the state proceed with implementation of a statewide high-speed train system by initiating the formal state and federal environmental review process through preparation of a state program-level Environmental Impact Report (EIR) and a federal Tier I Environmental Impact Statement (EIS) or Program EIR/EIS. The Authority is the state lead agency for the California Environmental Quality Act (CEQA) and the Federal Railroad Administration (FRA) is the federal lead agency for the National Environmental Policy Act (NEPA). As part of the Program EIR/EIS, a number of project alternatives will be evaluated including a High-Speed Train Alternative. Within the High-Speed Train Alternative, there is a range of high-speed train alignment and station options to be considered.

The purpose of this High-Speed Train Alignments/Stations Screening Evaluation is to consider all reasonable and practical options within the Bay Area-to-Merced corridor at a consistent level of analysis and focus the Program EIR/EIS on those alignment and station options that best attain the following objectives established by the Authority:

- Maximize ridership/revenue potential,
- Maximize connectivity and accessibility,
- Minimize operating and capital costs,
- Maximize compatibility with existing and planned development,
- Minimize impacts to natural resources,
- Minimize impacts to social and economic resources,
- Minimize impacts to cultural resources,
- Maximize avoidance of areas with geological and soils constraints, and
- Maximize avoidance of areas with potential hazardous materials.

This alignment and station screening evaluation was accomplished through the following key activities:

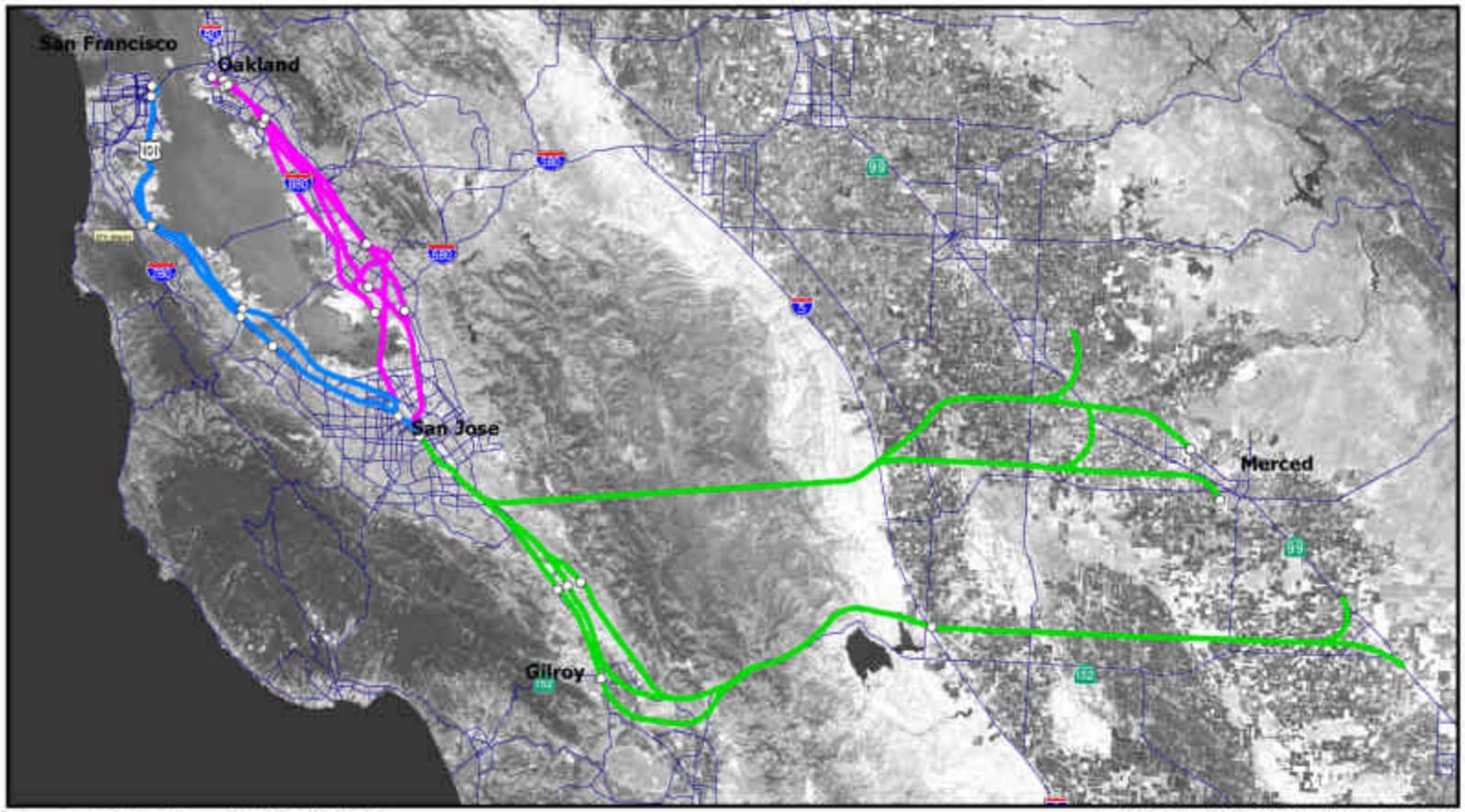
- Confirmation/reconsideration of prior alignment and station decisions based on review of previous studies,
- Identification of alignment and station options not previously evaluated through meetings with elected officials and public agencies and through the environmental scoping process,
- Evaluation of alignment and station options using standardized engineering, environmental, and financial criteria and evaluation methodologies, and
- Identification of the alignment and station options attainment of defined objectives.

S.1 ALIGNMENT AND STATION OPTIONS STUDIED

The Bay Area-to-Merced corridor has been divided into three segments for analysis purposes. These segments include: (1) Merced-to-San Jose, (2) San Jose-to-San Francisco, and (3) San Jose-to-Oakland. Alignment and station location options within these segments are summarized below and illustrated in Figure S.1-1.

[1] California High-Speed Rail Authority. Building a High-Speed Train System for California, Final Business Plan. June 2000.

Figure S.1-1: High-Speed Train Alignment and Station Options for the Bay Area-to-Merced Corridor



S.1.1 Merced-to-San Jose Segment (See Figure S.1-2)

The following alignments and stations were evaluated for the Merced-to-San Jose Segment. In this segment, all alignments would be on an exclusive guideway with separate tracks for high-speed trains and would connect to the Sacramento-to-Bakersfield high-speed train corridor.

- **Pacheco Pass/Gilroy/Caltrain Alignment**: This alignment would extend from Merced through the San Joaquin Valley and Pacheco Pass and then north along the Caltrain/Union Pacific Railroad (UPRR) rail corridor. Station options include Los Banos (near I-5) in the San Joaquin Valley, Gilroy (near the existing Caltrain Station), and the existing San Jose (Diridon) Station.

- **Pacheco Pass/Caltrain/Morgan Hill Alignment**: This alignment would extend from Merced through the San Joaquin Valley and Pacheco Pass and then north along the Caltrain/UPRR rail corridor. Station options include Los Banos (near I-5) in the San Joaquin Valley, Morgan Hill (near the existing Caltrain Station), and the existing San Jose (Diridon) Station.

- **Pacheco Pass/East of 101/Morgan Hill/Caltrain Alignment**: This alignment would extend from Merced through the San Joaquin Valley and Pacheco Pass, travel north in the U.S. 101 corridor, and then north along the Caltrain/UPRR rail corridor. Station options include Los Banos (near I-5) in the San Joaquin Valley, Morgan Hill (next to U.S. 101), and the existing San Jose (Diridon) Station.

- **Pacheco Pass/Foothills/Morgan Hill/Caltrain Alignment**: This alignment would extend from Merced through the San Joaquin Valley and Pacheco Pass, travel north in the foothills east of U.S. 101, and then north along the Caltrain/UPRR rail corridor. Station options include Los Banos (near I-5) in the San Joaquin Valley, Morgan Hill (in the foothills), and the existing San Jose (Diridon) Station.

- **Direct Tunnel Northern Alignment**: This alignment would pass from Merced (near Castle Air Force Base) through the San Joaquin Valley to a long (31-mile – 49.6 km) tunnel and onto the Caltrain/UPRR rail corridor north of I-85 and would have a station at the existing San Jose (Diridon) Station.

- **Direct Tunnel Southern Alignment**: This alignment would pass from Merced (at a Merced Municipal Airport Station) through the San Joaquin Valley to a long (31-mile – 49.6 km) tunnel and onto the Caltrain/UPRR rail corridor north of I-85 and would have a station at the existing San Jose (Diridon) Station.

S.1.2 San Jose-to-San Francisco Segment (See Figure S.1-3)

The following alignments and stations were evaluated for the San Jose-to-San Francisco Segment:

- **U.S. 101 Alignment to Transbay Terminal:** This alignment would be on an exclusive guideway in the U.S. 101 corridor. Station options include an optional station in Santa Clara, a station in Redwood City, a station in Millbrae (near the San Francisco International Airport), and a station in the lower level of the proposed new Transbay Terminal in San Francisco.

Figure S.1- 2: Alignments and Stations for the Merced-to-San Jose Segment

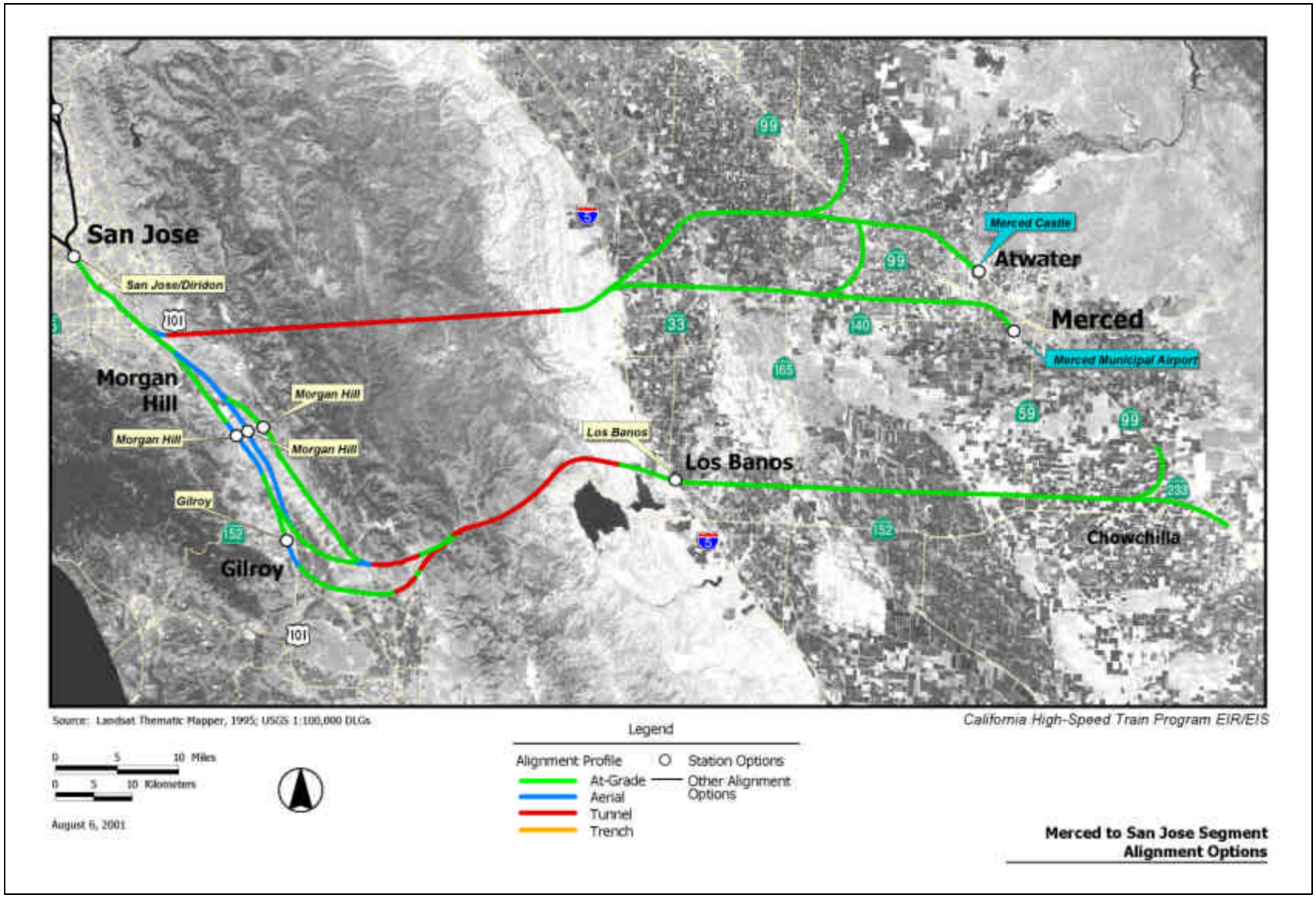
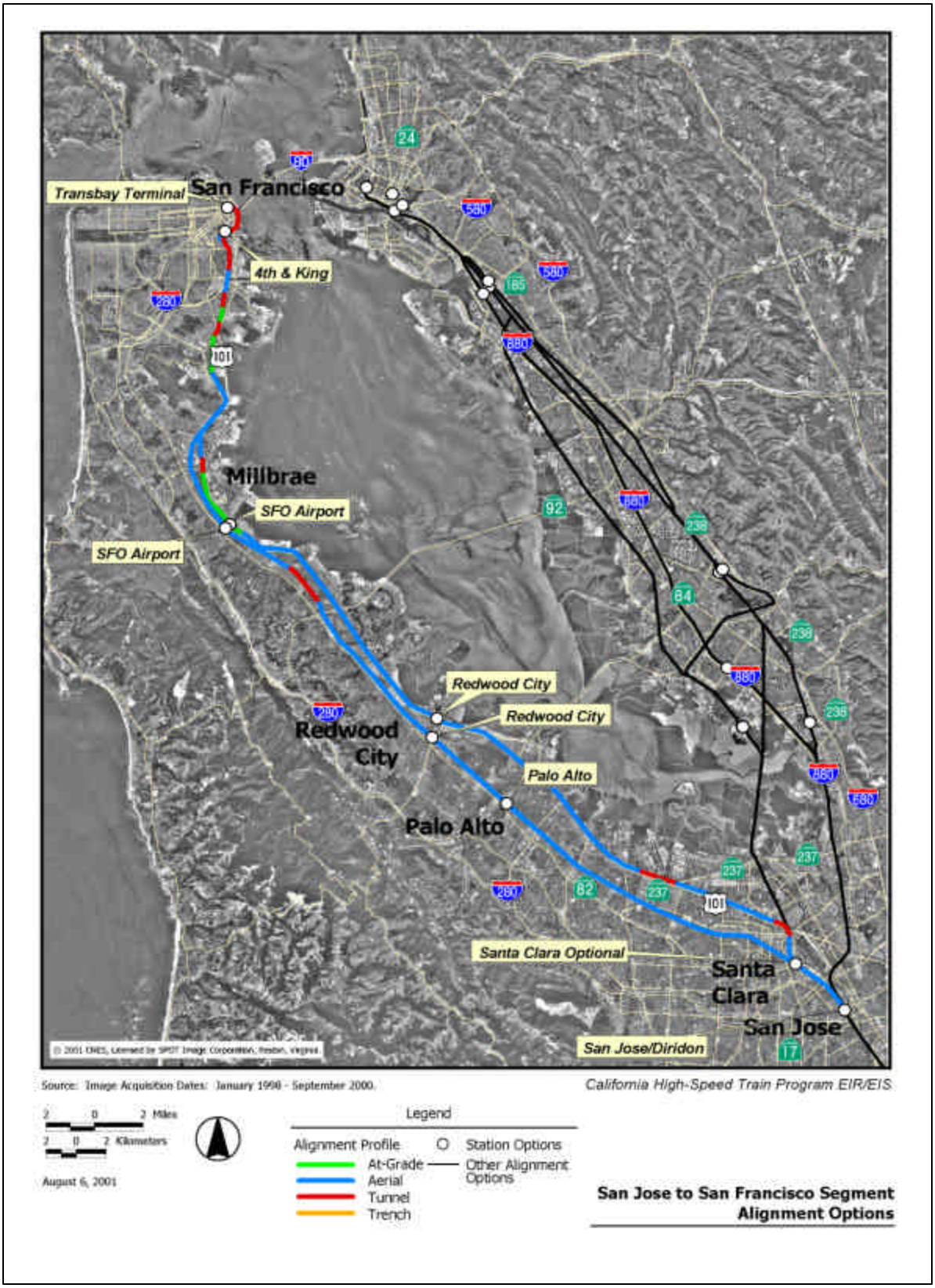


Figure S.1- 3: Alignments and Stations for the San Jose -to-San Francisco Segment



- **U.S. 101 Alignment to 4th and King**: This alignment would be on an exclusive guideway in the U.S. 101 corridor. Station options include an optional station in Santa Clara, a station in Redwood City, a station in Millbrae (near the San Francisco International Airport), and a station over the Caltrain yard/station at 4th and King streets in San Francisco.

- **Caltrain Corridor (Exclusive Guideway) to Transbay Terminal**: This alignment would be on an exclusive guideway within the Caltrain corridor. Station options include an optional station in Santa Clara, a station in either Redwood City or Palo Alto, a station in Millbrae (near the San Francisco International Airport), and a station in the lower level of the proposed new Transbay Terminal in San Francisco.

- **Caltrain Corridor (Exclusive Guideway) to 4th and King:** This alignment would be on an exclusive guideway within the Caltrain corridor. Station options include an optional station in Santa Clara, a station in either Redwood City or Palo Alto, a station in Millbrae (near the San Francisco International Airport), and a station over the Caltrain yard/station at 4th and King streets in San Francisco.

- **Caltrain Corridor (Shared-track with Caltrain) – Basic Service Option**: This option assumes that high-speed trains would share tracks with Caltrain commuter trains in the Caltrain corridor. The entire alignment would be grade-separated, but not all Caltrain stations would include four tracks. Station options include an optional station in Santa Clara, a station in either Redwood City or Palo Alto, a station in Millbrae (near the San Francisco International Airport), a station at 4th and King streets, and a station in the lower level of the proposed new Transbay Terminal in San Francisco.

- **Caltrain Corridor (Shared-track with Caltrain) – Four-track Station Option:** This option assumes that high-speed trains would share tracks with Caltrain commuter trains. The entire alignment would be grade-separated, and all Caltrain stations would either have four tracks or by-pass tracks. Station options include an optional station at Santa Clara, a station in either Redwood City or Palo Alto, a station in Millbrae (near the San Francisco International Airport), a station at 4th and King streets, and a station in the lower level of the proposed new Transbay Terminal in San Francisco.

S.1.3 San Jose-to-Oakland Segment (Se Figure S.1-4)

The following alignments and stations were evaluated for the San Jose-to-Oakland Segment:

- **Mulford Line (Entire Segment)**: From San Jose, this alignment would follow north along UPRR's entire Mulford rail line. Station options include Auto Mall Parkway, Oakland Airport/Coliseum, and downtown Oakland at one of the following locations: Lake Merritt, Jack London Square, West Oakland, or 12th Street/City Center.

- **I-880 (Entire Segment)**: From San Jose, this alignment would follow I-880 north to Oakland. Station options include Mowry Avenue, Oakland Airport/Coliseum I-880/Hagenberger, and downtown Oakland at one of the following locations: Lake Merritt, Jack London Square, West Oakland, or 12th Street/City Center.

- **I-880 to the Hayward Line (I-880/Hayward Alignment)**: From San Jose, this alignment would follow north along I-880 and then transition to UPRR's Hayward rail line. Station options include either the planned Warm Springs (Bay Area Rapid Transit -- BART Station) or the Union City (BART Station), Oakland Airport/Coliseum, and downtown Oakland at one of the following locations: Lake Merritt, Jack London Square, West Oakland, or 12th Street/City Center.
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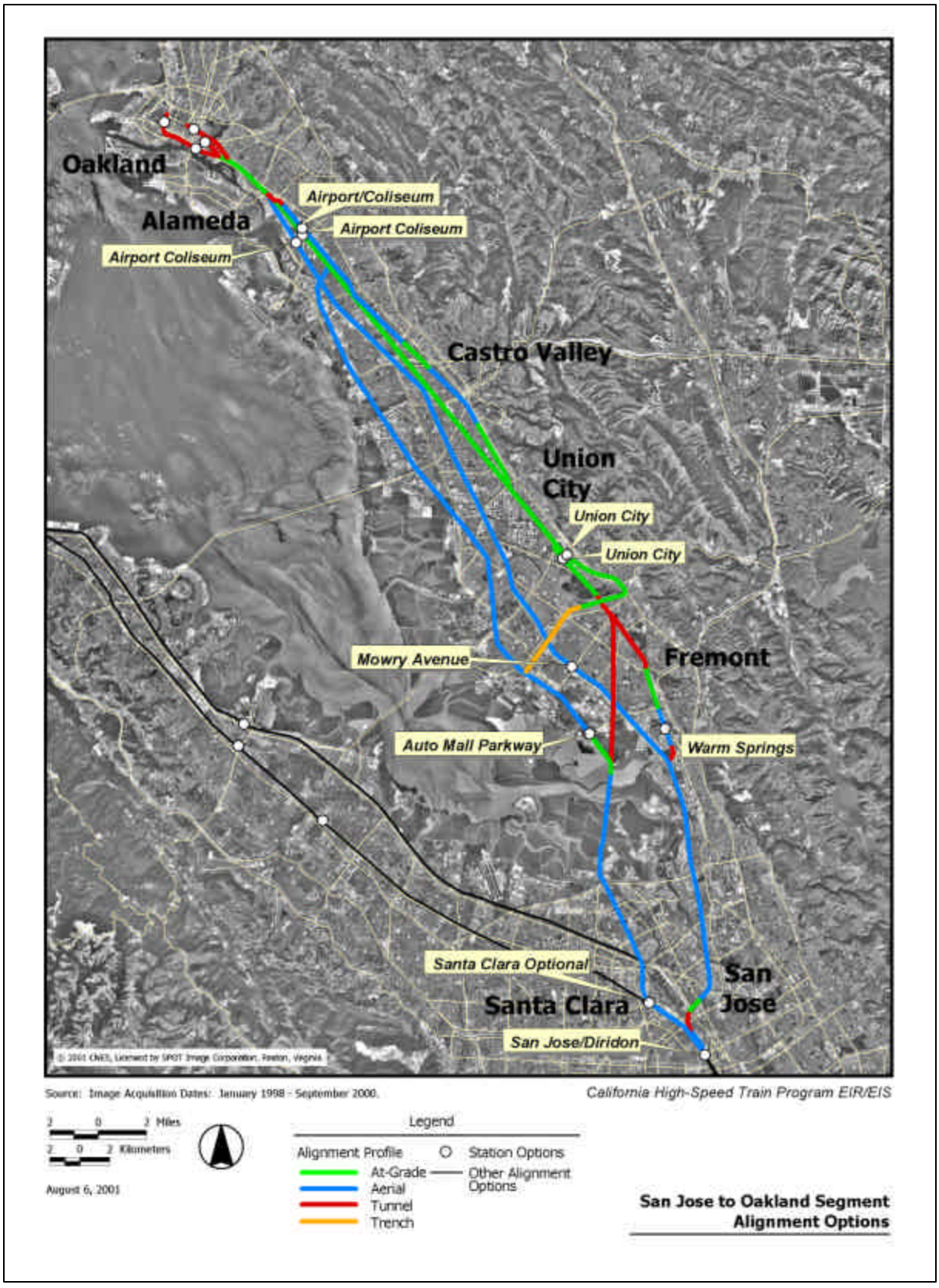
Figure S.1- 4: Alignments and Stations for the San Jose -to-Oakland Segment



- **I-880 to the Hayward Line to the former WPRR Rail Line (I-880/Hayward/WPRR Alignment)**: From San Jose, this alignment would follow north along I-880, transition to UPRR's Hayward rail line, and then transition to the UPRR (old WPRR) rail line. Station options include either the planned Warm Springs (BART Station) or the Union City (BART Station), Oakland Airport/ Coliseum, and downtown Oakland at one of the following locations: Lake Merritt, Jack London Square, West Oakland, or 12th Street/City Center.

- **Mulford Line through Niles Junction to the Hayward Branch (Mulford/Niles/Hayward Alignment)**: From San Jose, this alignment would travel north along UPRR's Mulford rail line to the UPRR's Niles line and then onto UPRR's Hayward line. Station options include either the planned Warm Springs (BART Station) or the Union City (BART Station), Oakland Airport/Coliseum, and downtown Oakland at one of the following locations: Lake Merritt, Jack London Square, West Oakland, or 12th Street/City Center.

- **Mulford Line via a tunnel to the Hayward Line (Mulford/Tunnel/Hayward Alignment)**: From San Jose, this alignment would follow north along UPRR's Mulford rail line to a tunnel leading to UPRR's Hayward rail line. Station options include either the planned Warm Springs (BART Station) or Union City (BART Station), Oakland Airport/Coliseum, and downtown Oakland at one of the following locations: Lake Merritt, Jack London Square, West Oakland, or 12th Street/City Center.

- **Mulford Line through Niles Junction to the former WPRR Rail Line (Mulford/Niles/WPRR Alignment)**: From San Jose, this alignment would follow UPRR's Mulford rail line to UPRR's Niles line, onto the UPRR's Hayward line, and then to the UPRR (formerly WPRR) rail line. It would have stations at either the planned Warm Springs (BART Station) or the Union City (BART Station), Oakland Airport/Coliseum, and in downtown Oakland at one of the following locations: Lake Merritt, Jack London Square, West Oakland, or 12th Street/City Center.

- **Mulford via a tunnel to the Former WPRR Line (Mulford/Tunnel/WPRR Alignment)**: From San Jose, this alignment would follow UPRR's Mulford rail line to a tunnel leading to UPRR's Hayward line and then transition to the UPRR (former WPRR) rail line. Station options include the planned Warm Springs (BART Station) or the Union City (BART Station), Oakland Airport/Coliseum, and downtown Oakland at one of the following locations: Lake Merritt, Jack London Square, West Oakland, or 12th Street/City Center.

S.2 ALIGNMENT AND STATION OPTIONS EVALUATION

The combined lengths (constructed miles) of various alignments from the Merced area to both San Francisco and Oakland range from 180 miles (288.3 km) to 218 miles (348 km). Express travel times from the southernmost point in the corridor (near Chowchilla and State Route 99 - SR-99) to San Francisco range from 67 to 81 minutes, depending upon the alignments. Express times for alignments from Chowchilla to Oakland range from 64 to 83 minutes.

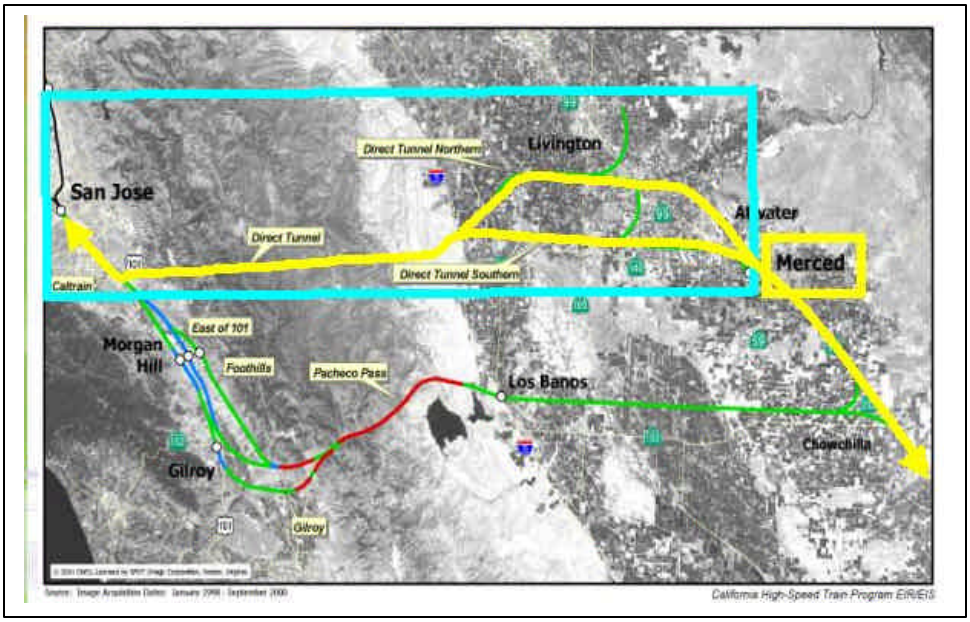
Substantial differences exist among the alignment and station options. Following is a summary, organized by segment, of major issues and differences identified during this screening process. The level to which each alignment and station option attains Authority objectives is described.

S.2.1 Merced-to-San Jose Segment

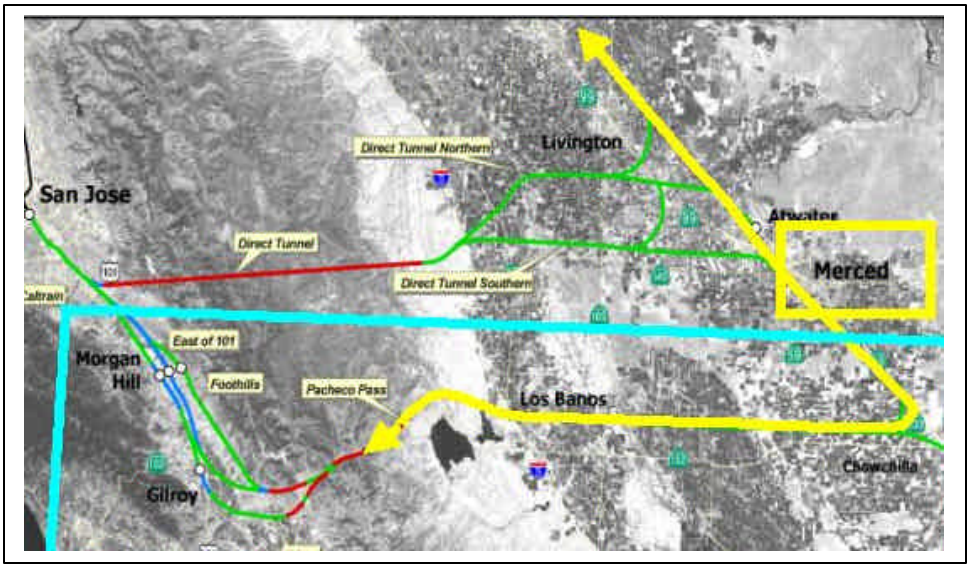
Figure S.1-2 shows the alignments and stations in the Merced-to-San Jose Segment. Tables S.2-1 and S.2-2 (at the end of this section) show the general degree to which alignment and station options meet overall objectives of the high-speed train program. Very distinct differences exist among the alignments and stations options in this segment.

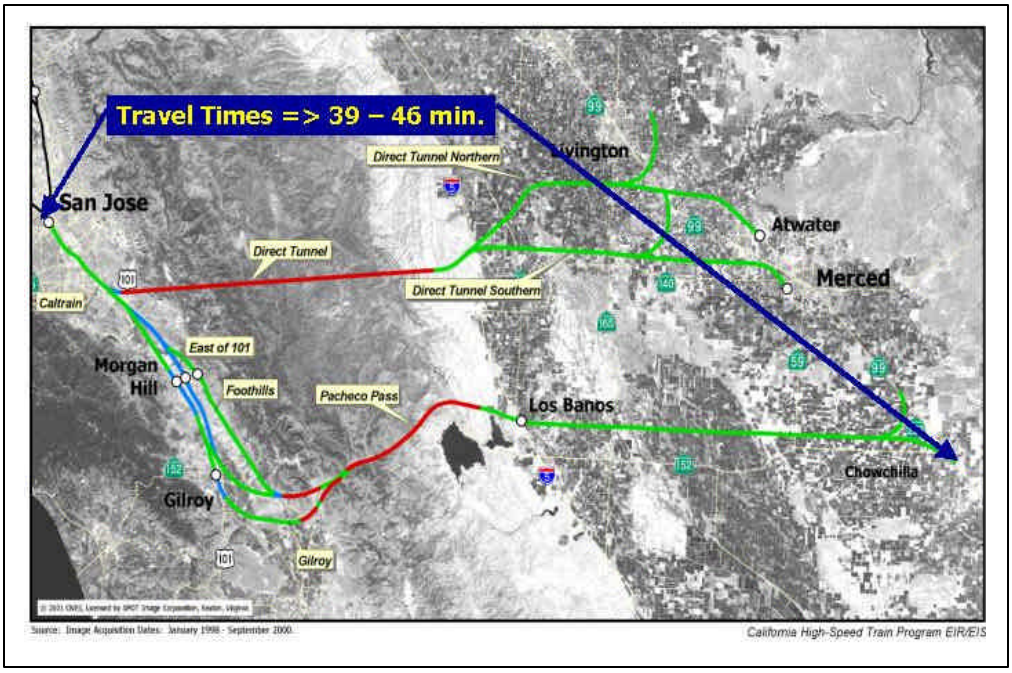
ALIGNMENT EVALUATION

Two Direct Tunnel alignments have been identified to serve two station options in Merced. Both would place Merced on the Los Angeles-to-Bay Area train line (rather than the Sacramento-to-Bay Area line), providing more frequent service to Merced. These alignments would involve construction of tunnels that are among the longest in the world (31 miles – 49.6 km) though mixed soil and geology types.

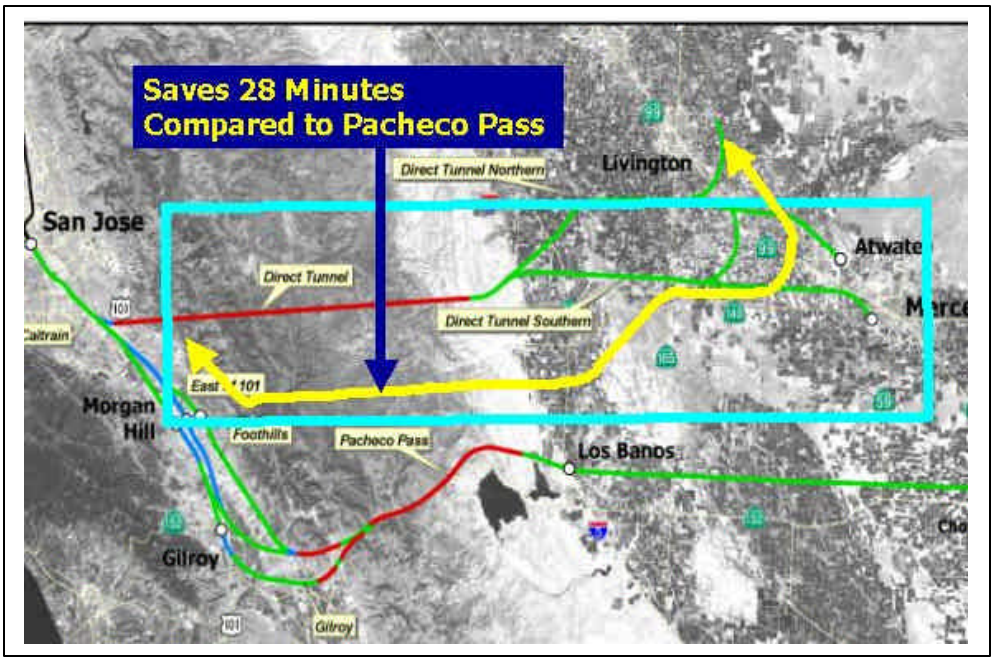


All of the Pacheco Pass alignment options would place Merced on the Sacramento-to-Bay Area high-speed train line, with less frequent service than the Los Angeles-to-Bay Area trains. As currently configured, the Pacheco Pass alignment options would also involve construction of tunnels, including a tunnel up to 13.5-mile (21.6 km) in length and one or two additional shorter tunnels. All Pacheco Pass alignments would provide high-speed train service to the Los Banos and the Gilroy or Morgan Hill areas. These areas would be bypassed by the Direct Tunnel alignments.



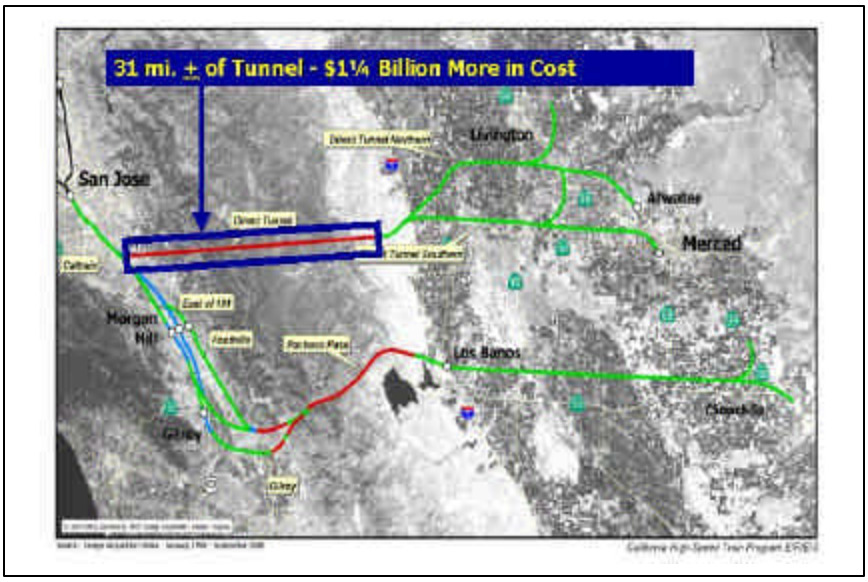


Express travel times from the Merced Area (near Chowchilla and SR-99) to the San Jose (Diridon) Station are similar. The lowest would be 39 minutes for the Direct Tunnel Southern, the Pacheco Pass/ East of 101, and the Pacheco Pass/ Foothills alignments. The highest travel time would be 46 minutes for the Pacheco Pass/ Gilroy/Caltrain Alignment. For local trains, the Direct Tunnel Southern Alignment, with a stop at a station in Merced, would save 11 minutes compared to the Pacheco Pass/Gilroy Alignment, with local stops in Los Banos and Gilroy.



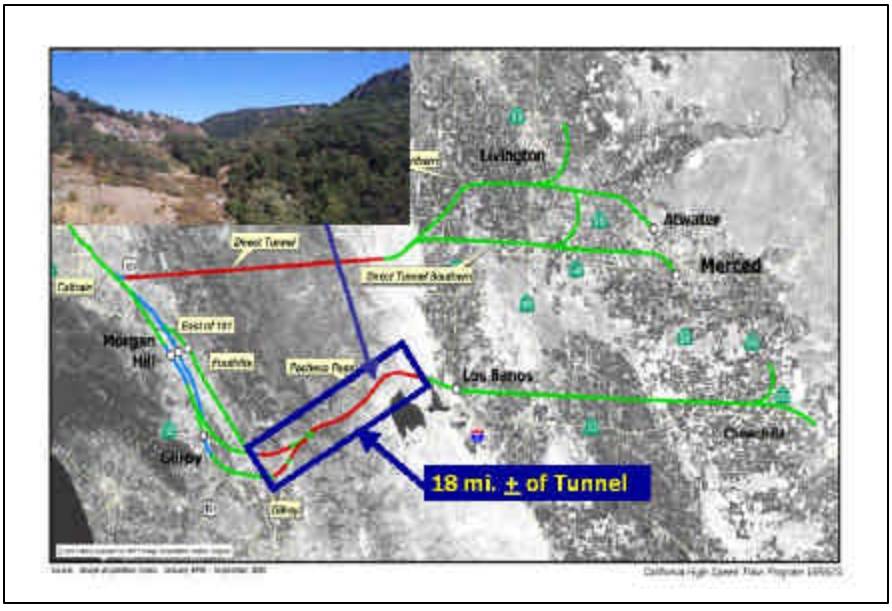
Significant differences exist among the alignments for travel times from Sacramento to the Bay Area. Both Direct Tunnel alignments would be approximately 28 minutes faster from Sacramento to San Jose than the Pacheco Pass/ Gilroy/Caltrain alignment, with a difference of 35 minutes for local trains. Operational cost savings would occur for this service, given that the Direct Tunnel alignments would be approximately 65 miles shorter than the Pacheco Pass/Gilroy Alignment, for example.

The Direct Tunnel alignments at 91-92 constructed miles (145.6-147.2 km) would be shorter in length than the Pacheco Pass alignment options by generally 25 miles (40 km). The Caltrain/ Morgan Hill, East of 101, and Foothills alignment options would be shorter than the Gilroy alignment by three to four miles (4.8 to 6.4 km). Minimal differences in length exist between the Caltrain/Morgan Hill, East of 101, and Foothills alignments.



Although shorter in length, the Direct Tunnel alignments are currently estimated to cost at least $1¼ billion more than the lowest cost Pacheco Pass alignment in the Foothills. The higher cost for the Direct Tunnel alignments is due largely to the long tunnel and the currently assumed unit cost per-mile for tunneling.

In addition, the Pacheco Pass alignments evaluated in previous Authority studies were designed to minimize the amount of tunneling. However, for this screening, an alignment was identified that that was lower in profile, allowing for an evaluation of reduced levels of disturbance on the surface, but resulting in approximately 18 miles of tunnel. While this would minimize environmental impacts, it increases the length of tunneling. Vertical alignments (depths) for the Pacheco Pass alignments need to be further evaluated, given the potential major cost differences in higher versus lower profiles, in more short tunnels versus fewer longer tunnels, and in potential environmental impacts of surface construction across sensitive natural areas. It is clear that different assumptions for tunneling unit costs and the vertical profile for the Pacheco Pass alternatives could potentially lead to an even greater disparity of costs between the Direct Tunnel and Pacheco Pass alignments. Additional analysis is necessary to gain a better understanding of and more confidence in the appropriate tunneling approach (e.g., use of tunnel boring machine versus drill and blast techniques) and associated cost estimates.



The Pacheco Pass/Foothills/Morgan Hill Alignment is the least costly of all alignments in this segment, primarily due to less tunneling and its shorter length compared to the other Pacheco Pass alignments. The Pacheco Pass/Caltrain/Morgan Hill Alignment is estimated to be about $200 million more, followed by the Pacheco Pass/Gilroy and the Pacheco Pass/East of 101 Alignment at about $300 million more.

Other major differences exist in terms of environmental factors. All alignments would cross the San Joaquin River, the California Aqueduct, creeks, and irrigation canals, and would pass through natural habitat, wetlands, and pristine mountainous terrain. The Direct Tunnel alignments would cross substantially fewer water resources (27 crossings) compared to the Pacheco Pass alignments (70-78 crossings – see Figure S.2-1). The Pacheco Pass alignments would cross the San Luis Wasteway but pass to the north of the O'Neil Forebay and San Luis Reservoir.

The Pacheco Pass alignments and the Direct Tunnel Southern Alignment would pass through the San Luis National Wildlife Refuge, which is characterized by major wetland areas, while the Direct Tunnel Northern Alignment would pass to the north of this Refuge. The Direct Tunnel Southern Alignment passes through a greater length of wetlands – approximately 4.4 miles (7 km), including the San Luis Wildlife Refuge, compared to the Northern alignment that would pass through an estimated 2.4 miles (3.8 km) of wetland areas and passes beyond the limits of the Wildlife Refuge.

The longest length of sensitive habitat would be along the Pacheco Pass/Foothills and East of 101 alignments. The Direct Tunnel alignments exhibit substantially lower levels (approximately 40 percent less) than the Pacheco Pass alignments. The Direct Tunnel Southern Alignment would pass though a higher level and number of critical habitats compared to the Northern Alignment.

Portions of all alignments would lie within areas subject to 100-year floods (see Figure S.2-1). The Gilroy, East of 101, and Caltrain to Morgan Hill alignments would include the longest lengths and percentages of alignment in the 100-year floodplain, with the least amount for the Direct Tunnel alignments, due to the 31-mile (49.6 km) tunnel segment. The Pacheco Pass/East of 101/Caltrain Alignment has the highest length of alignment in a 100-year floodplain and the highest number of floodplain and water resource crossings, followed closely by the Pacheco Pass/Gilroy/ Caltrain Alignment.

Effects on farmlands (severance, loss of access, drainage, etc.) are expected for all of the alignments east of I-5 in the San Joaquin Valley (see Figure S.2-2). Given the length of alignment underground, less impact to unique and prime farmlands would occur for the Direct Tunnel alignments compared to the Pacheco Pass Alignments. The highest level of impacts to unique farmlands and farmlands of statewide importance would occur with the Pacheco Pass/Gilroy Alignment (see Figure S.2-2).

Figure S.2- 1: Water Resources and Floodplains for the Bay Area-to-Merced Corridor

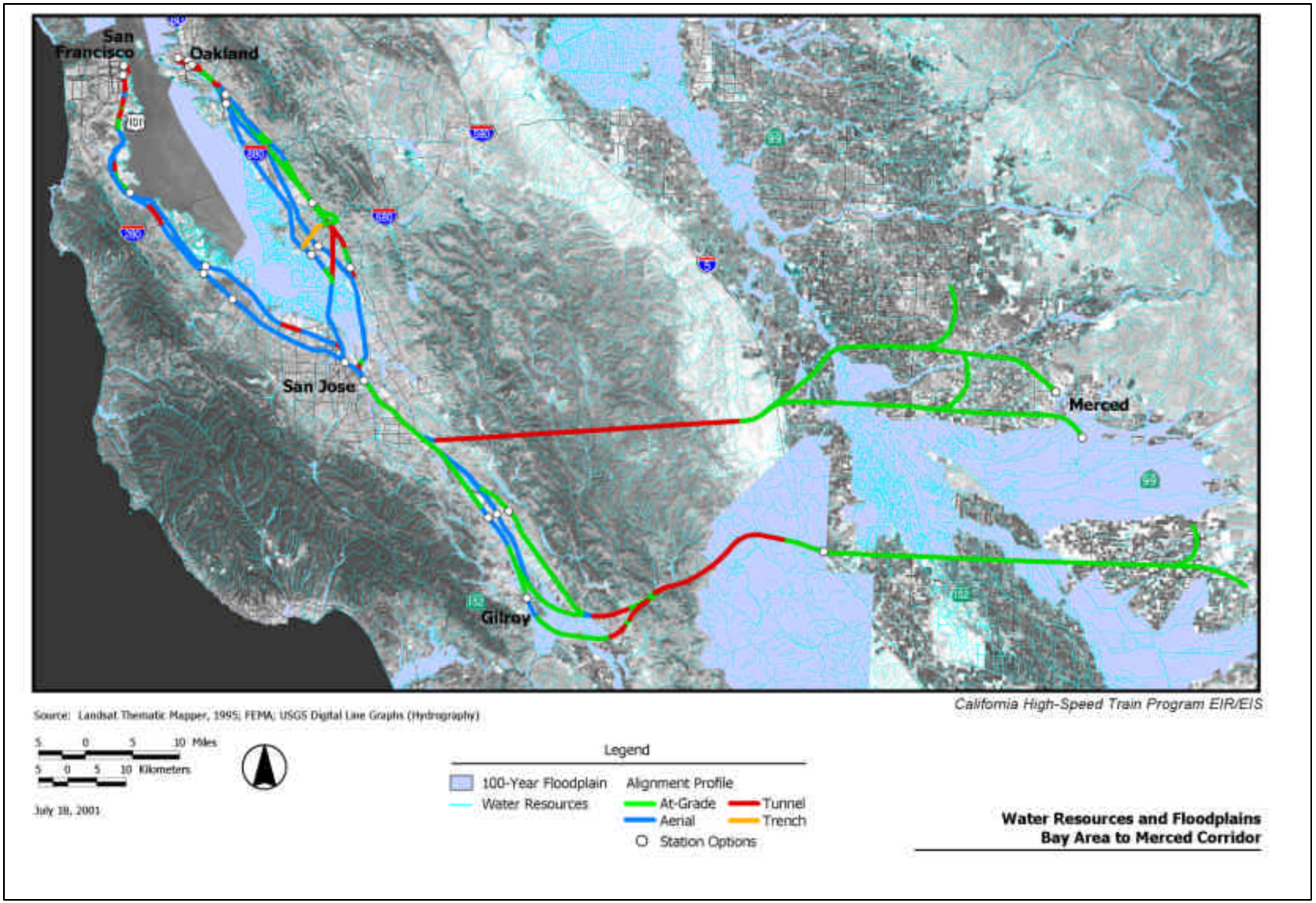
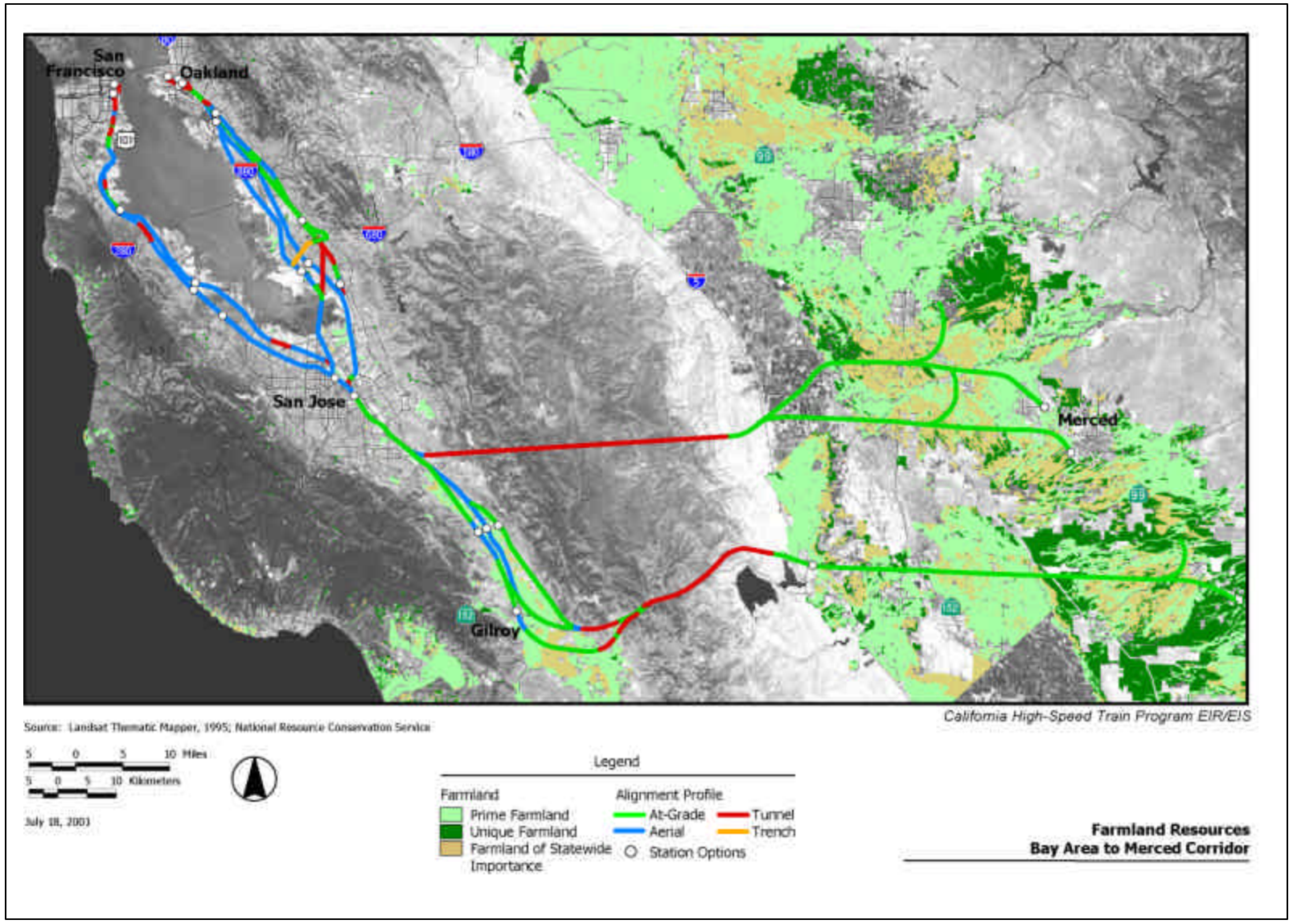


Figure S.2- 2: Farmlands for the Bay Area-to-Merced Corridor



The widening of the existing Caltrain/UPRR rail corridor to accommodate high-speed trains would represent fewer land use conflicts than would the introduction of aerial or at-grade alignments along the U.S. 101 or in the foothills, although fewer land use conflicts (aside from property acquisitions) would be expected from an alignment along side U.S. 101 than in the rolling hills, open fields, and low-density residential areas in the foothills.

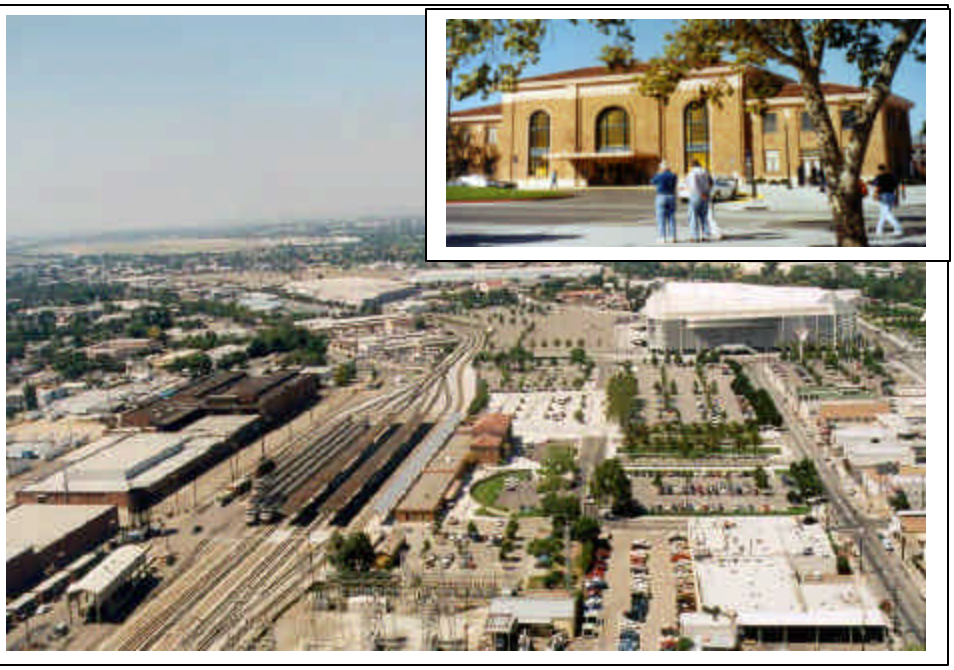
Potentially, the most critical impacts to minorities appear to be the possible acquisition of some properties in the southern portion of San Jose to the west of SR-87 on all alignments. While all alignments may have adverse impacts (visual, noise, etc.) on minority populations, the provision of high-speed train service should offer beneficial effects for all populations within the Bay Area-to-Merced corridor.

The Direct Tunnel alignment options would cross several active and potentially active faults in tunnel including the San Joaquin Fault, the Ortigalita Fault, the southern extension of the Greenville Fault trend, the Calaveras Fault zone, the Evergreen Fault, the Silver Creek Fault, and the Piercy Fault. The tunnels for the Pacheco Pass alignments would cross the Ortigalita Fault in tunnel. High-speed facilities would be designed taking into account existing soil, groundwater, and geologic conditions and to withstand maximum credible earthquakes from fault activity in the area.

STATION EVALUATION

The population and employment catchment numbers for the Los Banos Station are relatively small, generally 10 percent of other station catchment areas. The Gilroy or Morgan Hill stations would serve as catchment stations for the growing population areas to south, including the Salinas/Monterey and Santa Cruz areas, yielding population and employment catchment numbers over one million.

The San Jose Train Station (Diridon) is evolving into one of the major intermodal facilities in the Western United States, with existing connections to Caltrain, Capital Corridor, and ACE commuter rail services, Amtrak service, and Santa Clara Valley Transportation Authority (VTA) buses. The Vasona light rail system is currently under construction, and an extension of BART to this station is currently under study and partially funded. A high-speed train station at the San Jose (Diridon) would be completely supportive of San Jose's downtown strategic planning.



No critical land use conflicts are anticipated for the Los Banos, or the Caltrain corridor Gilroy or Morgan Hill stations. The Gilroy or Morgan Hill stations on the Caltrain Alignments would provide direct interconnections to Caltrain service. While the new high-speed train stations near the existing historic Gilroy and San Jose stations would introduce major new visual elements, they would enhance the use of both existing stations by expanding their multi-modal transportation functions.

The Pacheco Pass/Foothills Alignment station in Morgan Hill would require passengers to travel along the eastern portion of Cochrane Road, which is more suburban in nature and away from the center of Morgan Hill, exhibiting a mix of commercial and residential uses in a low-density rural setting.

Table S.2-1
Bay Area-to-Merced Corridor -- High-Speed Train Alignment Attainment of Objectives
Merced-to-San Jose Segment

OBJECTIVE	ALIGNMENTS					
	Pacheco Pass/ Gilroy/Caltrain	**Pacheco Pass/ Caltrain/ Morgan Hill**	**Pacheco Pass/ East of 101/ Morgan Hill/ Caltrain**	**Pacheco Pass/ Foothills/ Morgan Hill/ Caltrain**	**Merced Southern/ Direct Tunnel/ Caltrain**	**Merced Northern/ Direct Tunnel/ Caltrain**
Maximize Ridership/Revenue Potential	○	◑	◕	◕	●	●
	• Slowest travel time – 46 min. • Additional stations in Los Banos & Gilroy • Service to Merced reduced • Slower service between Sacramento & Bay Area • Local service travel at 58 min.	• Fast travel time – 43 min. • Additional stations in Los Banos & Morgan Hill • Service to Merced reduced • Slower service between Sacramento & Bay Area • Local service travel at 55 min.	• Fastest travel time – 39 min. • Additional stations in Los Banos & Morgan Hill • Slower service between Sacramento & Bay Area • Local service travel at 52 min.	• Fastest travel time – 39 min. • Additional stations in Los Banos & Morgan Hill • Slower service between Sacramento & Bay Area • Local service travel at 51 min.	• Fastest travel time – 39 min. • Local service travel at 47 min. • Better service to Merced Area on LA to Bay Area line • Faster service between Sacramento & Bay Area by 28 minutes for express service & 35 min. for local service	• Fast travel time – 42 min. • Local service travel at 50 min. • Better service to Merced Area on LA to Bay Area line • Faster service between Sacramento & Bay Area by 28 minutes and 35 min. for local service
Maximize Connectivity and Accessibility	◕	◑	◔	◑	●	●
	• Makes use of existing depot facilities in Gilroy – interface with Caltrain • Slower service between Sacramento & Bay Area • Service to Merced reduced	• Interface with Caltrain at Morgan Hill • Slower service between Sacramento & Bay Area • Service to Merced reduced	• No interface with Caltrain in Morgan Hill • Slower service between Sacramento & Bay Area • Service to Merced reduced	• No interface with Caltrain in Morgan Hill • Slower service between Sacramento & Bay Area • Service to Merced reduced	• Better service to Merced Area on LA to Bay Area line • Faster service between Sacramento & Bay Area	• Better service to Merced Area on LA to Bay Area line • Faster service between Sacramento & Bay Area
Minimize Operating and Capital Costs	◑	◑	◑	●	◔	◔
	• Longest length – 120 mi. (192 km) • Low capital costs • Greater operating costs • Maintenance of two tunnels required	• Shorter length than Gilroy Alignment – 117 mi. (187 km) • Lower capital cost • Greater operating costs than Direct Tunnels • Maintenance of two tunnels required	• Shorter length than Gilroy Alignment – 117 mi. (187 km) • Lower capital cost • Greater operating costs than Direct Tunnels • Maintenance of two tunnels required	• Shorter length than Gilroy Alignment – 116 mi. (186 km) • Lowest capital cost • Greater operating costs than Direct Tunnels • Maintenance of two tunnels required	• Shortest length – 92 mi. (147 km) • Highest capital cost – additional cost – at least $1.2 billion -- for tunneling • Less operating costs • Maintenance of 31 mi. tunnel required.	• Shortest length – 91 mi. (147 km) • Highest capital cost – additional cost – at least $1.2 billion -- for tunneling • Less operating costs • Maintenance of 31 mi. tunnel required.

OBJECTIVE	ALIGNMENTS					
	Pacheco Pass/ Gilroy/Caltrain	**Pacheco Pass/ Caltrain/ Morgan Hill**	**Pacheco Pass/ East of 101/ Morgan Hill/ Caltrain**	**Pacheco Pass/ Foothills/ Morgan Hill/ Caltrain**	**Merced Southern/ Direct Tunnel/ Caltrain**	**Merced Northern/ Direct Tunnel/ Caltrain**
Maximize Compatibility with Existing and Planned Development	○	◕	◔	○	●	●
	Impacts to: • Properties around Gilroy Station & Caltrain corridor for UPRR & highway relocation.	Impacts to: • Properties around Morgan Hill Station & Caltrain corridor for UPRR & highway relocation.	Impacts to: • Properties for Morgan Hill Station & commercial property along Freeway. • Properties along Caltrain corridor for UPRR & highway relocation.	Impacts to: • Properties for Morgan Hill Station & and residential an open space properties in foothills • Properties along Caltrain corridor for UPRR & highway relocation.	• Least impact due to long tunnel • Impacts to properties near 101 and crossing of SR-87	
Minimize Impacts to Natural Resources	○	◔	◔	○	●	◕
	• Second greatest impacts to waterways and floodplains • Impacts to sensitive habitat	• Impacts to sensitive habitat, water resources & floodplains	• Greatest impacts to waterways and floodplains • Second greatest Impacts to sensitive habitat	• Greatest impact to sensitive habitat – in foothills • Impacts to water resources & floodplains	• Due to tunnels, less impact to waterways & floodplains compared to Pacheco Pass Alts • More impacts on sensitive habitat than Northern Direct Tunnel	• Due to tunnels, less impact to waterways, floodplains, & sensitive habitat compared to Pacheco Pass Alts
Minimize Impacts to Social and Economic Resources	○	◑	◑	◕	●	
	• Greatest impacts to farmlands – east of I-5 & south of Gilroy	• Impacts to farmland east of I-5 & west of Pacheco Pass	• Impacts to farmland east of I-5 & west of Pacheco Pass	• Impacts to farmland east of I-5. • Least impact to farmland of Pacheco Pass Alts.	• Least impact due to long tunnel • Impacts to farmland north and east of Merced	
Minimize Impacts to Cultural Resources	◕					
	• Gilroy historic station • San Jose (Diridon) historic station • High-speed train stations supportive of existing historic station functions	• San Jose (Diridon) historic station • High-speed train stations supportive of existing historic station functions				

OBJECTIVE	ALIGNMENTS					
	Pacheco Pass/ Gilroy/Caltrain	**Pacheco Pass/ Caltrain/ Morgan Hill**	**Pacheco Pass/ East of 101/ Morgan Hill/ Caltrain**	**Pacheco Pass/ Foothills/ Morgan Hill/ Caltrain**	**Merced Southern/ Direct Tunnel/ Caltrain**	**Merced Northern/ Direct Tunnel/ Caltrain**
Maximize Avoidance of Areas with Geologic and Soils Constraints	●		◑		○	
	• Crosses Ortigalita Fault in tunnel. • Cross Silver Creek & Calaveras faults at-grade. For two tunnels: • Highly variable soil types • Multiple faults • Need to determine best tunneling approach • Ventilation/fire/life/safety issues	• Crosses Ortigalita Fault in tunnel. Cross Silver Creek and Calaveras faults in aerial. For two tunnels: • Highly variable soil types • Multiple faults • Need to determine best tunneling approach Ventilation/fire/life/safety issues			• Crosses San Joaquin, Ortigalita, Greenville, Piercy, & Calaveras faults in tunnel. For 31-mile tunnel: • Highly variable soil types • Multiple faults • Need to determine best tunneling approach • Ventilation/fire/life/safety issues	
	• All high-speed train facilities would be designed taking into account existing soil, groundwater, and geologic conditions in the area and to withstand maximum credible earthquakes from fault activity in the area					

○ ◔ ◑ ◕ ●

Least Favorable **Most Favorable**

Table S.2-2
Bay Area-to-Merced Corridor -- High-Speed Train Station Attainment of Objectives
Merced-to-San Jose Segment

OBJECTIVE	STATIONS			
	Los Banos	**Gilroy**	**Morgan Hill**	**San Jose (Diridon)**
	Pacheco Pass Alignments Only	**Gilroy Alignment Only**	**Caltrain** **E. of 101** **Foothills**	**All Alignments**
Maximize Ridership/Revenue Potential	○	◕	◕	●
	• 9,696 employment • 87,596 population	1,048,458 employment 1,016,375 population	• 1,048,458 employment • 1,016,375 population	• 905,644 employment • 366,338 population
Maximize Connectivity and Accessibility	◔	◕	◕ ◑ ◔	●
	• Freeway (I-5) access only	• Caltrain commuter rail • U.S. 101	• Caltrain commuter rail • U.S. 101 • Direct freeway access. No Caltrain connection • More distant from freeway. No Caltrain connection	• Caltrain, ACE, Capital commuter rail, Amtrak, VTA buses & light rail, possible BART
Minimize Operating and Capital Costs	●	◕	◕ ● ●	◑
	• No operational issues • Minimal capital costs	• Grade separated pedestrian connections needed to platforms & Caltrain • Moderate cost	• Grade separated pedestrian connections needed to platforms & Caltrain • Moderate cost • No operational issues • Moderate cost • No operational issues • Moderate cost	• Station would feed both San Francisco & Oakland lines. Track designations needed. • Grade separated pedestrian connections needed to platforms & Caltrain. • Costly two-level station
Maximize Compatibility with Existing and Planned Development	●	●	● ● ◔	●
	• Sparse rural & highway commercial – no conflicts	• Compatible with Gilroy Caltrain Station & commercial area • Design sensitivity to historic Gilroy station required	• Compatible with Morgan Hill Caltrain Station & commercial area • Compatible with freeway corridor/ commercial area • Generally incompatible with rural/ residential area	• Compatible with intermodal station. Design sensitivity needed for historic station & historic warehouse conversion to residential to the west

OBJECTIVE	STATIONS			
	Los Banos	Gilroy	Morgan Hill	San Jose (Diridon)
	Pacheco Pass Alignments Only	Gilroy Alignment Only	Caltrain E. of 101 Foothills	All Alignments
Minimize Impacts to Natural Resources	○	●	● ● ○	◕
	• San Joaquin Kit Fox	• None identified by statewide GIS	• None identified by statewide GIS • None identified by statewide GIS • California Tiger Salamander	• California Tiger Salamander • Highly urban area
Minimize Impacts to Social and Economic Resources	◔	●	● ◔ ●	●
	• In prime farmland	• Not in farmland	• Not in farmland • In prime farmland • Not in farmland	• Not in farmland
	• No disproportionate impacts anticipated for minority or low-income areas. High-speed train system would provide benefits to all populations.			
Minimize Impacts to Cultural Resources	●	◕	●	◕
	• None identified by statewide GIS	• Will enhance intermodal function of historic station. Design sensitivity needed.	• None identified by statewide GIS	• Will enhance intermodal function of historic station. Design sensitivity needed for historic station & historic warehouse conversion to residential to the west.
Maximize Avoidance of Areas with Geologic and Soils Constraints	• All high-speed train facilities would be designed taking into account existing soil, groundwater, and geologic conditions in the area and to withstand maximum credible earthquakes from fault activity in the area			

○ ◔ ◑ ◕ ●
Least Favorable **Most Favorable**

S.2.2 San Jose-to-San Francisco Segment

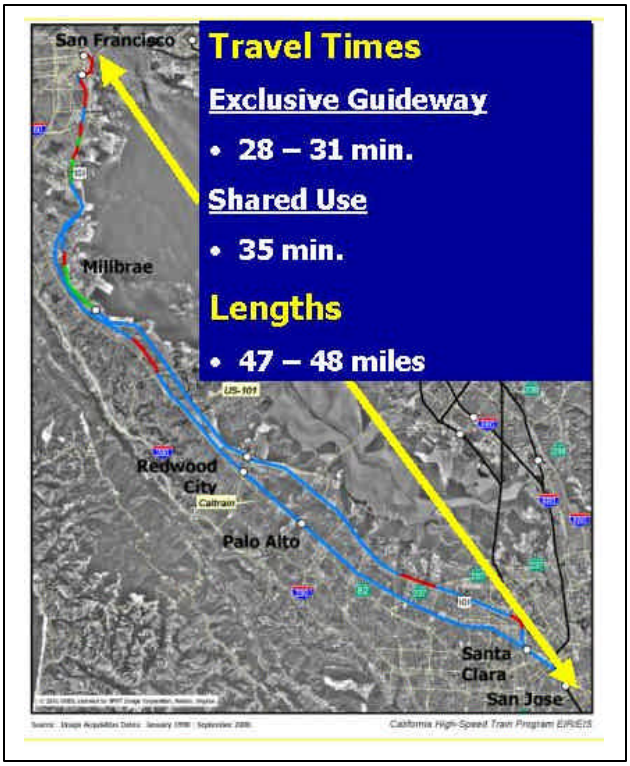
Figure S.1-3 shows the alignments and stations in the San Jose-to-San Francisco Segment. Tables S.2-3 and S.2-4 at the end of this section show the general degree to which these alignment and station options meet overall objectives of the high-speed train program.

ALIGNMENT EVALUATION

The high-speed train alignments along the San Francisco Peninsula travel on one of two existing major transportation corridors – Caltrain or U.S. 101. Three alignments are evaluated in these two corridors. The first two are on in the U.S. 101 and Caltrain corridors on an exclusive guideway with separate tracks for high-speed trains. The third option would share tracks with Caltrain commuter trains. This Shared Use option would need to use the steel-wheel-on-rail technology.

Two shared use options are considered. The first would grade-separate the entire Caltrain alignment but would not expand the number of tracks beyond that which is currently planned by the Peninsula Commute Joint Powers Board (JPB). This Basic Service Option would include some Caltrain stations with only two tracks – Redwood City, San Mateo, Paul Avenue, and 22nd Street – and some with only three tracks – Mountain View, Menlo Park, Atherton, Sunnyvale, Santa Clara, and College Park.

The second option – Four Track Station Option – would provide four tracks or a bypass track for all Caltrain stations so that high-speed trains would not be slowed or stopped by Caltrains at the two- and three-track stations.



Lengths of the Caltrain and the U.S. 101 alignments are also essentially the same – between 47 and 48 miles (75 to 77 km), and travel times for these exclusive guideway alignments are also similar at 28 to 30 minutes. Maximum speeds would be constrained by existing curves on the Caltrain and U.S. 101 corridors, although operations would be generally the same on either.

Travel times for the Caltrain Shared Use Four-track Station Option is estimated to be about five minutes longer. For the Shared Use options, high-speed train operations would need to be coordinated and integrated with Caltrain and freight service. There would be a potential for delays or reduced service frequency for high-speed trains due to the need to share the tracks. The Four-track Station Option would reduce this potential by eliminating the possibility of local Caltrains stopped at stations slowing or blocking high-speed trains. However, maximum authorized speed on the Caltrain tracks is not expected to be as high as would be possible with an exclusive guideway, so travel times are expected to be longer.

Estimated capital costs of the Caltrain and U.S. 101 exclusive guideway alignments are similar, with between $200 to $400 million more for the U.S. 101 alignments. Both exclusive guideway alignments would involve extensive use of aerial structures, with some tunnel segments. It is estimated that there will be more right-of-way (ROW) and cost required for the U.S. 101 corridor than for Caltrain, given that there is little space available for expansion adjacent to the Freeway. In addition, the freeway has substandard features (e.g., medians and shoulders) in many places, and it is assumed that any room that might be available for high-speed train facilities likely would be used by Caltrans to upgrade the freeway in these areas. By contrast, there appears to be space available adjacent to the Caltrain ROW to construct an aerial structure partially overhanging the tracks and partially over adjacent streets where they are present.

Estimated capital costs for the Caltrain Shared Use options are substantially lower – approximately $1 billion less for the Basic Service Option and $400 less million for the Four-track Station Option. This assumes that the high-speed train program would pay for generally ½ the costs for electrifying the Caltrain corridor and ½ the costs for an extension of Caltrain to the Transbay Terminal.

For the Basic Service Option, additional significant costs would be for grade separation of 47 of the existing grade crossings and the construction of pedestrian overpasses at the Caltrain stations. For the Four-track Station Option, there would be additional costs for aerial structures and a tunnel, but these costs are somewhat offset by the reduced number of Caltrain grade separations that would need to be constructed for high-speed trains.

A major portion of the Caltrain corridor passes through industrial areas, but there are critical locations where it passes through principally residential land uses. The corridor also passes through suburban town centers, oftentimes with development immediately adjacent to the rail line (e.g., San Mateo, Redwood City).

The U.S. 101 corridor is generally more commercial, but it also has numerous segments of residential uses near or immediately adjacent to the freeway, typically behind a freeway noise wall.

The aerial portions of the separate use alignments on both the Caltrain and U.S. 101 corridors would introduce a major new visual element along the U.S. 101 and Caltrain corridor. Such facilities could have critical visual impacts (intrusion/shade/shadow) on the residential portions

for both of these alignments. Introduction of the elevated structure could also have adverse impacts on the suburban town centers along the Caltrain corridor. Although the structure would generally be in a commercial area in these centers, it could represent a barrier for land use and urban design, depending on design and environmental mitigation characteristics. The 47 grade separations required for the Caltrain corridor Shared Use options would introduce critical design and land use issues. The Caltrain corridor Shared Use Option would have substantially fewer visual impacts, although visual impacts would occur at locations where grade separations would need to be constructed, depending in part on the design of such separations.

Both the Caltrain and U.S. 101 corridors cross several creeks, and the U.S. 101 Alignment would be near or intrude on waterways connected to the San Francisco Bay in the Redwood City, Belmont, San Mateo, Burlingame, and Foster City areas (e.g., the Coyote Point County Recreation Area, and Robert E. Woodley Park – see Figure 2.2-1). Structures passing near or over or intruding into these waterways would need to designed to minimize impacts to these waters and any associated sensitive natural habitat. The U.S. 101 Alignment would pass through 37 percent more sensitive habitat than would the Caltrain corridor Alignments.

The U.S. 101 Alignment would pass through or near multiple parklands, and the Caltrain Corridor Alignment would pass though El Palo Alto Park. Consistent with Section 4(f) of the Department of Transportation Act of 1966, additional analyses and design will need to be undertaken to determine if there are prudent alternate alignments that would avoid these parklands or if design elements can be applied to minimize impacts to these parklands.

Minority populations exist along both alignments north of Santa Clara Station and in the southern portion of San Francisco County, and along the U.S. 101 Alignment in the Palo Alto area. However, given the location of the alignments, none is expected to have disproportionate adverse effects on minority populations. Moreover, all populations should realize beneficial effects from the provision of high-speed train service.

The exclusive guideway alignments would have similar construction issues, involving the construction of an aerial guideway adjacent to and above very busy and active existing transportation facilities, while maintaining traffic, either highway or rail. For the exclusive guideway options, construction of the tunnel in San Francisco to the Transbay Terminal site from 17th Street would be particularly difficult. Most of the tunnel would need to be constructed using compressed air techniques in very soft ground.

Station Comparison

The largest employment and population catchment for stations in this segment would occur in downtown San Francisco at the 4th and King an Transbay Terminal Station, given the high density of employment and residents. With its strategic location in Silicon Valley, the optional station at Santa Clara exhibits a large population and employment catchment, even assuming a station in San Jose (Diridon). Moreover, a Santa Clara station could also serve the San Jose International Airport.

The station in Millbrae exhibits the next highest catchment level, principally due to its strategic location near the San Francisco International Airport (SFIA). The Millbrae Station on the Caltrain corridor would provide better access to SFIA via the BART service than would a bus shuttle from the U.S. 101 Millbrae Station. With their lower density development and employment centers, the Redwood City and Palo Alto stations exhibit the lowest levels of employment and population catchment. Figures S.2-3 and S.2-4 show the anticipated population and employment densities in the Year 2020 for the San Jose, San Francisco, and Oakland Areas.

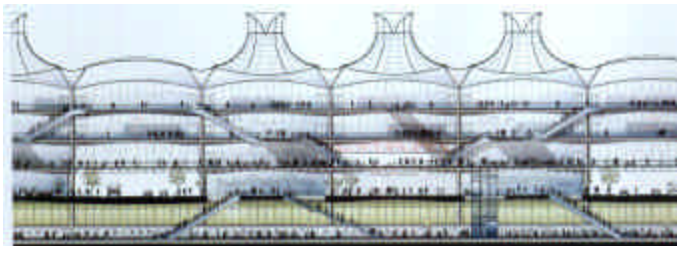
Stations along the U.S. 101 corridor should be easier to construct than those along the Caltrain corridor. All U.S. 101 stations would be located adjacent to but off the freeway ROW. Proposed separate use stations on the Caltrain corridor would be on aerial structures above or immediately adjacent to active railroad tracks, making them more difficult and time-consuming to construct.

Six historic train stations exist along the Caltrain corridor. Separate use alignments along the Caltrain corridor would have more severe impacts on these historic stations than would the Shared Use options.

The possible Redwood City station location on the U.S. 101 Alignment is currently a go-kart and family entertainment area with relatively little development. On the Caltrain corridor, the ROW at the Redwood City location is only 40 feet wide, and there is commercial development on both sides of the station. The station site at Palo Alto previously had four tracks, so there is potentially enough ROW above the Caltrain tracks for a high-speed train station.

The Caltrain corridor stations in Redwood City, Palo Alto, Millbrae all would be in suburban town centers, characterized mainly by commercial development. Given the assumption of a station structure over the ROW for the Caltrain corridor Separate Use Alignment, the stations could introduce critical visual/shade/shadow impacts, particularly for the Historic Palo Alto and Millbrae stations. The Shared Use options would be generally consistent with and complementary to these town centers, although necessary grade separations in these centers would involve land acquisition and relocation of uses as well as reconfiguration of the street system. The ultimate design of the grade separations would affect the degree of land use conflict for the town centers. The optional Caltrain corridor station at Santa Clara would be generally consistent with the commercial and industrial character of the area, but would need to take into account the historic designation of the existing Santa Clara Station.

U.S. 101 stations in Redwood City and Millbrae would be compatible with surrounding land uses, which are mainly commercial. Vehicular access from the freeway for the U.S. 101 corridor stations would be better compared to vehicular access for the Caltrain corridor stations. Thus, traffic impacts for the U.S. 101 Alignment stations would be less disruptive than in the suburban town centers. Additionally, it appears that provision of parking facilities at the U.S. 101 Alignment station sites would be less disruptive to adjoining land uses compared to the Caltrain corridor sites.



The JPB and the City and County of San Francisco are currently planning for a new Transbay Terminal in the heart of the City's Financial District/South of Market Area at First and Mission streets. Included in this proposal is new multi-modal Transbay Terminal, an extension of Caltrain 1.5 miles from its current terminus at 4th and King to the basement of the new terminal, and over seven million square feet of transit oriented development in the area surrounding the new terminal. This facility would serve as a major multi-modal center for the employment center of San Francisco, with direct access to multiple modes of transit including AC transit, MUNI, and Greyhound buses, Caltrain commuter rail, paratransit services, and a possible underground connection to a BART station on Market Street. The proposed new terminal would allow for high-speed train service.

Figure S.2-3: Projected Population Density in the Bay Area (Year 2020)

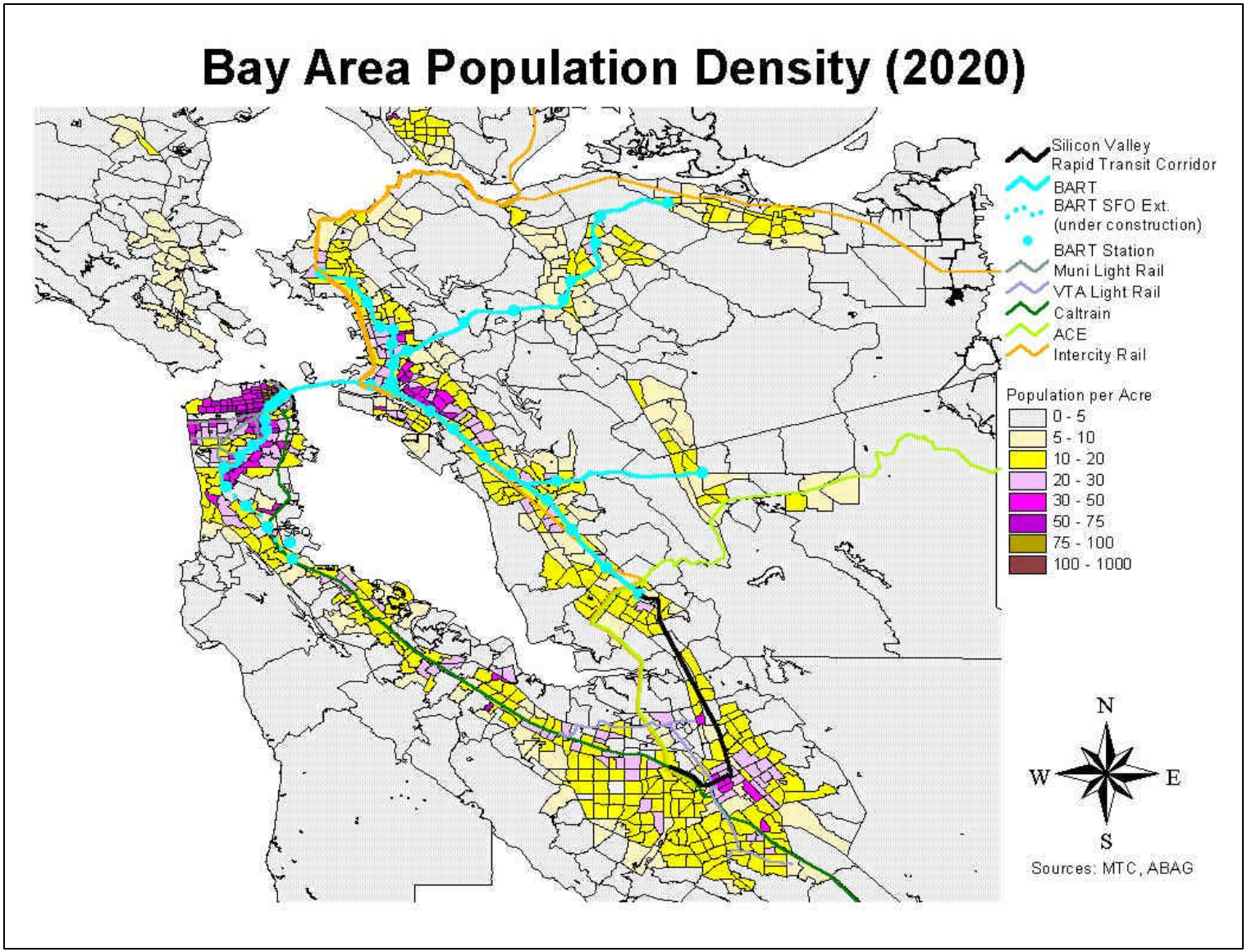
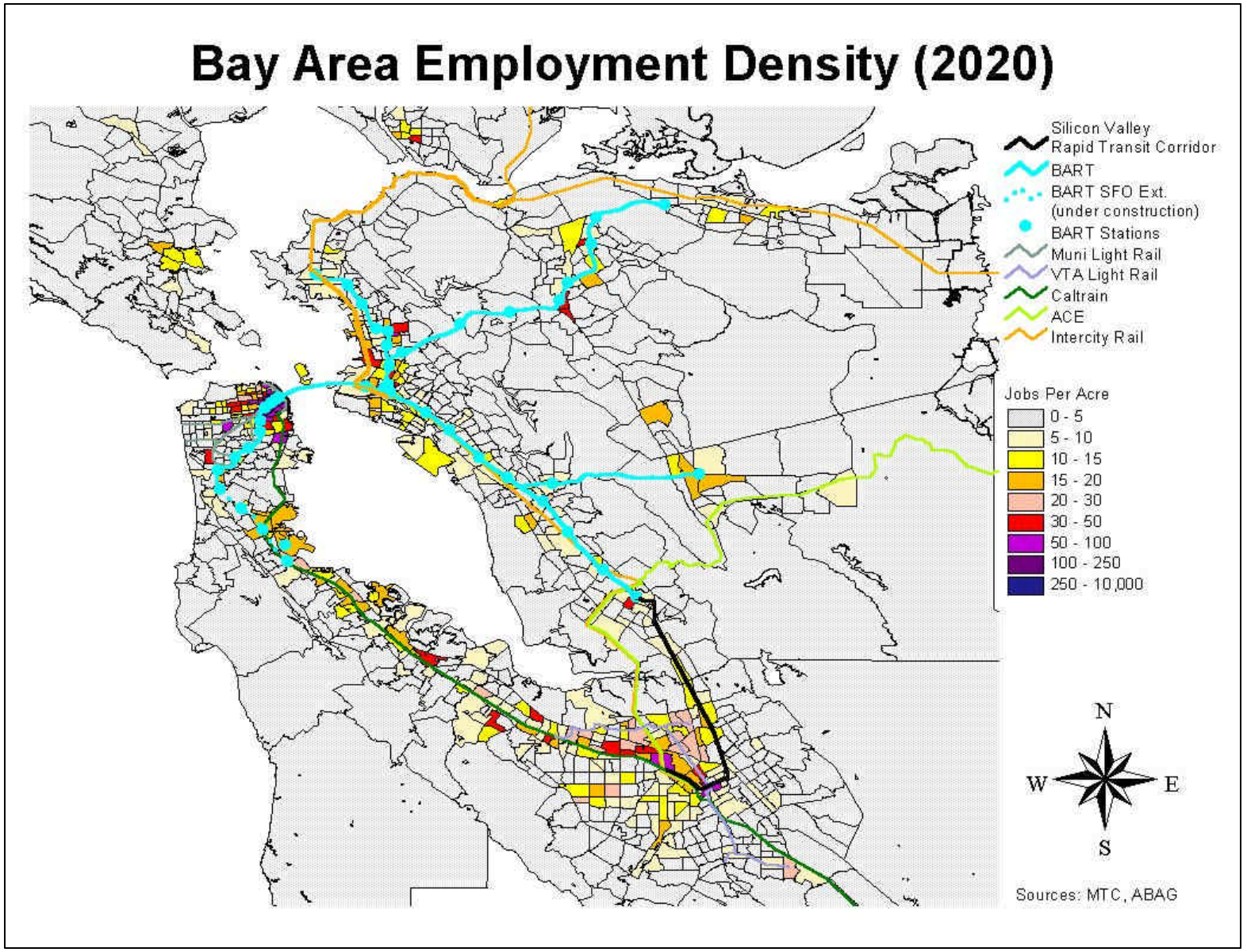


Figure S.2-4: Projected Employment Density in the Bay Area (Year 2020)



The major station issue with respect to the Peninsula exclusive guideway alignments appears to be the location of the San Francisco terminal. It does not appear that an alignment with stations at both Mission Bay (at 4th and King) and downtown (at the Transbay Terminal) is feasible for the exclusive guideway alignments. The deep tunnel alignment in poor soils conditions (bay mud) leading to the Transbay Terminal would not readily allow for a cost-effective station, while the proposed aerial station over the Caltrain Yard could not be readily extended to the Transbay Terminal. Therefore, the exclusive guideway alignments would only have one station in San Francisco.

For the Caltrain Shared Use options, either the Basic Service or the Four-track Station Option would allow a station at both 4th and King and at the new Transbay Terminal, if the proposed Caltrain downtown terminal is implemented. This possible provision of two stations in San Francisco likely would create greater flexibility for high-speed train operations to the City.

For both the Caltrain and U.S. 101 alignments, the Millbrae stations would be subject to 100-year floods, as would the Redwood City Station on the U.S. 101 Alignment. Station facilities would be designed to be above 100-year flood levels to the extent possible.

Table S.2-3
Bay Area-to-Merced -- High-Speed Train Alignment Attainment of Objectives
San Jose-to-San Francisco Segment

OBJECTIVE	ALIGNMENTS					
	U.S. 101 (Exclusive Guideway)		Caltrain (Exclusive Guideway)		Caltrain (Shared Use)	
	Transbay Terminal Station	4th & King Terminal Station	Transbay Terminal Station	4th & King Terminal Station	Basic Service Option w/Grade Separations	Four-track Station Option
Maximize Ridership/Revenue Potential	●	◕	●	◕	◑	◕
	• Generally equal travel times: 28-31 min. • Increased ridership at Transbay Terminal multi-modal facility				• 35 min. express trave time without track capacity constraints due to shared use • Constraints may occur at 2- & 3-track stations • Need to optimize commuter & high-speed train schedules	• 35 min. express trave time without track capacity constraints due to shared use • All 4-track stations • Need to optimize commuter & high-speed train schedules
Maximize Connectivity and Accessibility	●	◕	●	◕	●	
	• Better vehicular access from Freeway • Improved connectivity at Transbay Terminal	• Better vehicular access from Freeway	• Interconnectivity with Caltrain at midline stations – Redwood City, Palo Alto, Millbrae (& optional Santa Clara) • Improved connectivity at Transbay Terminal		• Interconnectivity with Caltrain at midline stations – Redwood City or Palo Alto, Millbrae (and optional Santa Clara)	

OBJECTIVE	ALIGNMENTS					
	U.S. 101 (Exclusive Guideway)		Caltrain (Exclusive Guideway)		Caltrain (Shared Use)	
	Transbay Terminal Station	4th & King Terminal Station	Transbay Terminal Station	4th & King Terminal Station	Basic Service Option w/Grade Separations	Four-track Station Option
Minimize Operating and Capital Costs	◔		◔		◕	●
	• Generally equivalent lengths: 47-48 mi. • Generally equivalent operating costs				• Equivalent lengths: 48 mi. • More costly to operate due to track/ station capacity constraints	• Fewer capacity constrains at stations – less costly to operate than Basic Service Option
	• Most costly	• High cost	• High cost	• HighCost	• Substantially less cost by approx. $1 billion than exclusive guideway • Assumes High-speed Train Program would pay approximately ½ the cost of Caltrain Electrification and the San Francisco Caltrain Downtown Extension	• Less costly by approx $400 Mil. than exclusive guideway
Maximize Compatibility with Existing and Planned Development	◑		◑		◑	
	• Major ROW purchase required		• Major ROW purchase required		• ROW required for grade separations	
	Fewer land use impacts compared to Caltrain corridor		• Land use (visual, barriers, shade/ shadow) & traffic impacts to suburban town centers		• Grade separations will have land use impacts	
	• Fully compatible with Transbay Terminal plans	• Visual impacts at 4th & King	• Fully compatible with Transbay Terminal plans	• Visual impacts at 4th & King		
Minimize Impacts to Natural Resources	◔		◑		◕	
	• More water crossings than Caltrain corridor • Greater impacts to sensitive habitat than Caltrain corridor		• Fewer water crossing than U.S. 101 corridor • Fewer impacts to sensitive habitat		• Impacts from grade separations less severe	• Impacts from grade separations & station by-pass tracks less severe

OBJECTIVE	ALIGNMENTS					
	U.S. 101 (Exclusive Guideway)		Caltrain (Exclusive Guideway)		Caltrain (Shared Use)	
	Transbay Terminal Station	4th & King Terminal Station	Transbay Terminal Station	4th & King Terminal Station	Basic Service Option w/Grade Separations	Four-track Station Option
Minimize Impacts to Social and Economic Resources	●					
	• No impacts to farmlands No disproportionate impacts to minorities of low-income					
Minimize Impacts to Cultural Resources	●		○		●	◕
	• 3 historic resources		• Adverse effects on 6 historic train stations: Santa Clara, Palo Alto, Menlo Park, San Carlos Burlingame, & Millbrae.		• No effects on 6 historic train stations	• Possible adverse effects on Santa Clara, Menlo Park, & Burlingame historic stations from single-track bypass structures – depending on design & location of bypass
Maximize Avoidance of Areas with Geologic and Soils Constraints	• All high-speed train facilities would be designed taking into account existing soil, groundwater, and geologic conditions in the area and to withstand maximum credible earthquakes from fault activity in the area					

○ ◔ ◑ ◕ ●

Least Favorable **Most Favorable**

Table S.2-4
Bay Area-to-Merced Corridor -- High-Speed Train Station Attainment of Objectives
San Jose-to-San Francisco Segment

OBJECTIVE	STATIONS					
	Santa Clara (Optional)	**Redwood City**	**Palo Alto**	**San Francisco Airport**	**Fourth/ King**	**Transbay Terminal**
	U.S. 101 & Caltrain Separate Use & Caltrain Shared Use	**U.S. 101 Caltrain Separate Use Caltrain Shared Use**	**Caltrain Separate Use Caltrain Shared Use**	**U.S. 101 Caltrain Separate Use Caltrain Shared Use**	**U.S. 101 & Caltrain Separate Use Caltrain Shared Use**	**U.S. 101 & Caltrain Separate Use Caltrain Shared Use**
Maximize Ridership/Revenue Potential						
	• 982,532 employment • 845,419 population Assumes a station at San Jose (Diridon)	• 363,620 employment • 196,560 population	• 363,620 employment • 196,560 population	• 446,180 employment • 255,272 population	• 1,649,168 employment • 1,130,289 population • Assumes a station in Oakland	• 1,649,168 employment • 1,130,289 population
Maximize Connectivity and Accessibility		  		  		
	• Caltrain • ACE • Capital Corridor • VTA buses • Possible connector to San Jose Airport	• VTA buses • 101 Freeway	• Caltrain • Samtrans buses	• Samtrans busses • Airport shuttles • 101 Freeway	• Caltrain • MUNI Metro • MUNI buses • 280 Freeway	• AC Transit buses • Greyhound • Para-transit • MUNI buses • Caltrain
	• Caltrain • ACE • Capital Corridor • VTA buses • Possible connector to San Jose Airport	Caltrain • Caltrain • VTA buses		Caltrain • Caltrain • Samtrans buses • BART to SFO & San Francisco • 101 Freeway		
Minimize Operating and Capital Costs		  	 	  	 	 
	• No operating issues for separate use • Moderate costs			U.S. 101 • Moderate costs	U.S. 101 & Separate Use • Costly aerial station over Caltrain yard	U.S. 101 & Separate Use • Tunneling through difficult geology • Use of new Transbay Terminal – assumes cost sharing
				Separate Use • Costly aerial station over Caltrain	Shared use • Use of existing station & track	Shared Use • Use of Caltrain extension & new Transbay Terminal – assumes cost sharing
	• Caltrain Shared Use Options: Coordination required with Caltrain regarding use of tracks, schedules, station operations, use of common & separate facilities, passenger flows, & other physical and operating relationships.					

OBJECTIVE	STATIONS					
	Santa Clara (Optional)	**Redwood City**	**Palo Alto**	**San Francisco Airport**	**Fourth/ King**	**Transbay Terminal**
	U.S. 101 & Caltrain Separate Use & Caltrain Shared Use	**U.S. 101 Caltrain Separate Use Caltrain Shared Use**	**Caltrain Separate Use Caltrain Shared Use**	**U.S. 101 Caltrain Separate Use Caltrain Shared Use**	**U.S. 101 & Caltrain Separate Use Caltrain Shared Use**	**U.S. 101 & Caltrain Separate Use Caltrain Shared Use**
Maximize Compatibility with Existing and Planned Development	◕	● ◑ ◕	◑ ◕	● ◑ ◕	◕ ◕ ●	●
	• Generally compatible with commercial/ industrial area • Must be sensitive to historic station	U.S. 101 • Station on commercial or undeveloped land • Better ability to accommodate parking structure compared to Caltrain location • Better vehicular traffic access than Caltrain location	Caltrain Separate Use • Introduce major structure over Caltrain ROW in town center – potential for critical visual/shade/ shadow impacts and land use barrier • .	U.S. 101 • Station on commercial or undeveloped land • Better ability to accommodate parking structure compared to Caltrain location • Better vehicular traffic access than Caltrain location	U.S. 101 & Separate Use • Large station structure over existing Caltrain yard & station – generally compatible	• Fully compatible & complementary
		Caltrain Separate Use • Introduce major structure over Caltrain ROW in town center – potential for critical visual/shade/ shadow impacts and land use barrier		Caltrain Separate Use • Introduce major structure over Caltrain ROW in town center – potential for critical visual/shade/ shadow impacts and land use barrier		
		Caltrain Share Use • Generally compatible with commercial in suburban town centers – grade separations in town centers could be disruptive to land use & street system			• Fully compatible & complementary	
Minimize Impacts to Natural Resources	●			◑	●	
	• No impacts identified on statewide database			• Potential impacts to California Clapper Rail	• No impacts identified on statewide database	
Minimize Impacts to Social and Economic Resources	●	◕		●		
	• No disproportion impacts anticipated	• Minority populations in station area No disproportion impacts anticipated		• No disproportion impacts anticipated		
	• No stations located in farmlands					

OBJECTIVE	STATIONS					
	Santa Clara (Optional)	**Redwood City**	**Palo Alto**	**San Francisco Airport**	**Fourth/ King**	**Transbay Terminal**
	U.S. 101 & Caltrain Separate Use & Caltrain Shared Use	**U.S. 101 Caltrain Separate Use Caltrain Shared Use**	**Caltrain Separate Use Caltrain Shared Use**	**U.S. 101 Caltrain Separate Use Caltrain Shared Use**	**U.S. 101 & Caltrain Separate Use Caltrain Shared Use**	**U.S. 101 & Caltrain Separate Use Caltrain Shared Use**
Minimize Impacts to Cultural Resources	◑	●	○ ◑	● ○ ◑	●	●
	• Historic Train Station • Mitigation and/or sensitive design required	• No known cultural resources	<u>Caltrain Separate Use</u> • Historic Train Station • Mitigation and/or sensitive design required	<u>U.S. 101</u> • No known cultural resources <u>Caltrain Separate Use</u> • Historic Train Station • Mitigation and/or sensitive design required	• No known cultural resources	• Existing Historic Terminal • No impacts anticipated at new terminal
		Caltrain • No known cultural resources	<u>Caltrain Shared Use</u> • Historic Train station • Mitigation and/or sensitive design required			
Maximize Avoidance of Areas with Geologic and Soils Constraints	• All high-speed train facilities would be designed taking into account existing soil, groundwater, and geologic conditions in the area and to withstand maximum credible earthquakes from fault activity in the area					

○ ◔ ◑ ◕ ●

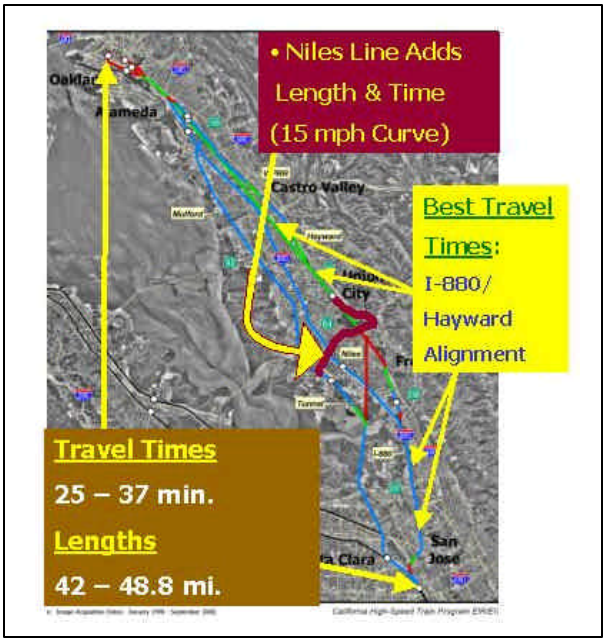
Least Favorable **Most Favorable**

S.2.3 San Jose-to-Oakland segment

Figure S.1-4 shows the alignments and stations in the San Jose-to-Oakland Segment. Tables S.2-5 and S.2-6 at the end of this section show the general degree to which these alignment and station options meet overall objectives of the high-speed train program.

ALIGNMENT COMPARISON

The alignments in the San Jose-to-Oakland Segment follow, for the most part, four major existing transportation corridors in the East Bay, including the Mulford, Hayward, and WPRR rail lines and I-880. Each alignment uses the entire corridor or a combination of corridors, with transitions from one corridor to the other.



The travel times for this segment vary from 25 to 37 minutes. The longest travel times are for alignments using the existing Niles Junction tracks, which has some significant right-angle turns resulting in increased length and reduced speed. Existing speed is limited to 15 mph (24 kmph), although it is assumed that this could be increased to 30 mph (48 kmph) for high-speed trains.

The longest alignment is also the slowest – the Mulford / Niles/ WPRR Alignment, with a length of 48.8 miles (78 km). The fastest travel time is for the I-880/Hayward Alignment, which is the shortest alignment at 41.8 miles (67 km).

The two lowest capital cost alignments are the I-880/Hayward and Mulford/Niles/Hayward alignments, which are almost identical in cost. Alignment combinations with the most tunnel and aerial structure have the highest cost, i.e., alignments that incorporate the Fremont tunnel and all of I-880. These include the Mulford/Tunnel/Hayward Alignment, the Mulford/Tunnel/WPRR, and the I-880 (Entire Segment). The remaining Mulford Alignments without the Fremont tunnel range would be lower in cost. Alignment combinations with the most at-grade sections have the lowest cost, i.e., alignments that incorporate the Hayward and WPRR corridors. These include the I-880/Hayward and the I-880/WPRR alignments.

The Mulford Alignment would require a portion of the UPRR corridor (that is generally 60 feet – 18.3 m – wide) for aerial structure foundations and for an aerial easement over the tracks. In addition, a 50-foot (15.2 m) right-of-way strip would be needed from the residential, commercial, and light industrial areas to the east of the alignment.

The I-880 (Entire Segment) Alignment would require significant ROW in the more northern area to be able to expand the highway sufficiently to allow for high-speed tracks in the median. For the Hayward and WPRR alignments, ROW would be required along the BART/UPRR corridor near Warm Springs and an underground easement below Fremont Central Park for a tunnel. For the Hayward and the WPRR segments, the UPRR would need to agree to sell a portion of the Hayward line and the entire WPRR segment.

The greatest visual impact would be for the aerial alignments in a narrow corridor. The Mulford line is generally a 60-foot (18.3 m) wide corridor. An aerial structure in this corridor would be visually intrusive for adjoining residential and commercial properties. Although similar in design, the I-880 aerial structure would be less intrusive, given that it would be in the median of a wide highway. The structure would be more intrusive as it passes over the existing cross roadways approaching a height of 40 feet (12.2 m). The proposed alignment along the Hayward branch would be at-grade and follow the existing freight and commuter railroad. It would be closer to adjoining properties than the existing track by approximately 35 feet (10.7 m) but visually compatible with the existing rail use. The high-speed train structures for the WPRR alignment would be similar to the BART structures adjacent to it, thereby having a lesser visual impact.

The Mulford alignments would cross multiple marshlands, seasonal wetland, rivers, plus approximately four miles of the Don Edwards San Francisco Bay National Wildlife Refuge – a major wildlife and bird sanctuary. High-speed train operations may be limited through the Refuge to reduce impacts to wildlife. These alignments also include the highest length passing through sensitive habitat and within the 100-year floodplain (see Figure S.2-1), a portion of which is the Wildlife Refuge. Additionally, the Mulford alignments would have the greatest effect on farmlands (see Figure S.2-2), and the highest number of water resource crossings (39-40). The number of water resource crossings is reduced for the Mulford Tunnel alignments, with 31-32 crossing, but these still include the Wildlife Refuge.

Alignments using the I-880, either for its entire length or in combination with the Hayward or WPRR rail lines, would have the fewest crossings (21 to 23). The Hayward and WPRR alignments would tunnel under the Fremont Central Park Lake.

Minority populations reside along the Mulford line in Santa Clara County, along all alignments in central Alameda County, and in the southern, western, and central portions of Oakland. With the distribution of minority populations along all alignments, disproportionate impacts to these populations are not anticipated. Moreover, provision of high-speed train service should offer beneficial effects for all populations within the Bay Area-to-Merced corridor.

An affirmative survey was not performed for cultural resources. However, based on available information, the Mulford alignments would pass over the historic railroad north of Santa Clara

Station (Centerville to Santa Clara) and through the historic communities of Alviso and Drawbridge. The Mulford/Niles alignments would also pass through the historic area of Niles.

All alignments in the San Jose-to-Oakland Segment would cross the Silver Creek Fault. The Hayward and WPRR Alignments would cross and run parallel to Hayward Fault, a major fault in the Bay Area. High-speed train facilities would be designed to account for anticipated maximum credible earthquakes from fault activity in the area.

The I-880 Alignment aerial configuration is similar to the Mulford Alignment. It would require construction of footings within the highway ROW and lane closures during construction. This likely would result in off-peak construction. As the highway narrows, requiring full median widening, construction issues would be similar to major highway reconstruction – demolition of existing adjacent property, new noise walls, demolition of existing noise walls, construction of new highway lanes, and maintenance of traffic.

The WPRR Alignment would have major construction issues including rearrangement of BART foundations to allow for the high-speed alignment to pass from one side of BART to the other. The Hayward Alignment would begin in I-880 and present construction issues associated with constructing columns and footings in a wide median. The tunnel under the park in Fremont would represent major construction issues due to the high water table and the presence of gravels.

The Niles connector would follow the existing UPRR tracks, which would have to be separated for the high-speed alignment. This would result in a 100-foot (30.5 m) wide trench requiring complicated maintenance of traffic solutions for freight and commuter traffic. The Fremont tunnel would need to be constructed in similar geotechnical conditions as the tunnel under Fremont Central Park, except that this tunnel would be significantly longer and under proposed commercial development.

STATION EVALUATION

Stations exist along each alignment in Southern Alameda County and near the Oakland Airport, with four possible terminal station locations in Oakland. Population and employment catchment levels for the South Alameda County Stations are generally the same and important given their location near employment areas of Silicon Valley (see Figure S.2-4). The Coliseum Station catchment is lower, but would provide a direct connection to Oakland Airport (via the proposed Oakland Airport Connector), and would serve special functions at the Coliseum as well as provide

a connection to the BART Station. The population catchments for the Oakland terminal stations are equal and very significant.

With the exception of the I-880 Alignment, the stations would provide direct interconnection with at least one other rail transit provider – Altamont Commuter Express, Capital Corridor, Amtrak, and BART. In most locations, high-speed train stations would be adjacent to existing or planned transportation facilities and generally compatible with adjoining land uses. Stations with a physical configuration similar to the adjacent transportation facilities should have limited visual impact. These include Auto Mall Parkway, Warm Springs, Union City, and Coliseum/Airport/BART stations.

Major issues associated with the Warm Springs Station include the need to relocate the planned BART station to the east and construct the station and facilities between two active railroads – BART and the UPRR. Relocating BART under operating conditions would be a very difficult task technically and operationally, an could be cost-prohibitive.

The I-880 station near Mowry Avenue would present difficult construction issues over an active highway and could have a high visual impact as an aerial station over the highway. The I-880 Coliseum/Airport Station would have a similar high impact with bents across the highway, and would present construction issue requiring major bent structures across the northbound lanes of I-880.

The Coliseum/Airport/BART Station on the Mulford and Hayward alignments would require the reconstruction of the Capitol Corridor platforms and, could require construction of the station in the lower level of new planned development.

The Jack London Square Station and alignment leading to and from it would be in bored tunnels in the bay mud underneath the Embarcadero and the active UPRR tracks. Relocating the railroad even temporarily is probably not an option. A cut-and-cover access would need to be constructed within the Amtrak parking lot and a mined concourse excavated over the bored tunnels. This would be extremely difficult construction and could be cost-prohibitive.

The cut-and-cover section of the West Oakland Station in the median of Mandela Parkway would be in a residential neighborhood, requiring appropriate construction techniques to minimize noise, dust, and traffic maintenance. The Lake Merritt Station and alignment segment would require construction of a tunnel or subway through the campus of Laney College adjacent to the BART alignment.

The City Center Terminal Station would be constructed adjacent and perpendicular to the existing BART station. The platform level is assumed to be one level deeper than the BART platform, so a portion of the BART Station would need to be supported in place. Passing under BART would be a major construction issue requiring mining techniques for this short section – approximately 60 feet (18.3 m). This station would be the deepest of the terminal station options, and the extra levels for excavation could be used for parking or connection to existing underground parking.

All of the high-speed train stations in Oakland (West Oakland, Jack London Square, City Center, Lake Merritt, Airport/Coliseum/BART) are in areas with minority populations greater than 50 percent. The potentially most adverse effects from Oakland stations located in minority areas would be during construction of the Lake Merritt and West Oakland stations. Residential uses are more proximate to these station sites, compared to the Jack London Square and the City Center, which are more commercial in nature.

Table S.2-5
Bay Area-to-Merced Corridor -- High-Speed Train Alignment Attainment of Objectives
San Jose-to-Oakland Segment

OBJECTIVE	ALIGNMENTS							
	Mulford (Entire Segment)	**Mulford/ Niles/ Hayward**	**Mulford/ Niles/ WPRR**	**Mulford/ Tunnel/ Hayward**	**Mulford/ Tunnel/ WPRR**	**I-880 (Entire Segment)**	**I-880/ Hayward**	**I-880/ WPRR**
Maximize Ridership/Revenue Potential	◑	◔	○	◕	◑	◑	●	◕
	• Travel time of 31 min. • Limited by existing rail alignment	• Travel time of 34 min. • Speed restriction in Niles Junction	• Slowest travel time -- 37 min. • Speed restrictions in Niles Junction	• Second fastest travel time of 27 min. due to tunnel	• Travel time of 30 min. • Limited by WPRR geometrics	• Travel time of 32 min. • Limited by freeway curves	• Fastest travel time – 25 min.	• Travel time of 28 min. • Limited by WPRR geometrics
Maximize Connectivity and Accessibility	●							
	• Depending on station locations, all alignments connect to BART, ACE and Capital Corridor commuter trains. • Jack London Square Station connects with Amtrak • I-880 Alignment would have best freeway access							
Minimize Operating and Capital Costs	◔	◑	◑	○	○	◔	●	●
	• Length – 42.3 miles (67.7 km) • Middle capital cost • Plus $250 mil.	• Length – 46.2 miles (73.9 km) • Higher operating costs due to Niles Junction • Lower capital cost	• Longest alignment – 48.8 miles (78.1 km) • Highest operating costs due to Niles Junction • Lower capital cost	• Length – 42.2 miles (67.5 km) • Higher capital cost • + $500 mil	• Length – 44.8 miles (78.1 km) • Highest capital cost • + $500 mil.	• Length – 42.0 miles (67.2 km) • Middle capital cost • + $250 mil.	• Shortest alignment – 41.8 miles (66.9 km) • Lowest operating costs • Lowest capital cost	• Length – 44.4 miles (71 km) • Lower capital cost
Maximize Compatibility with Existing and Planned Development	○	◑		◔		●		
	• Aerial easement & guideway over private property • Within existing transportation corridor • Conflicts with expansion potential of existing rail service providers	• Within existing transportation corridor • Conflicts with expansion potential of existing rail service providers		• Conflicts with expansion potential of existing rail service providers • Requires subsurface easements for tunnel		• Within existing transportation corridor		

OBJECTIVE	ALIGNMENTS							
	Mulford (Entire Segment)	**Mulford/ Niles/ Hayward**	**Mulford/ Niles/ WPRR**	**Mulford/ Tunnel/ Hayward**	**Mulford/ Tunnel/ WPRR**	**I-880 (Entire Segment)**	**I-880/ Hayward**	**I-880/ WPRR**
Minimize Impacts to Natural Resources	○	◔	◔	◑	◑		◕	
	• Crosses approximately four miles of the Don Edwards San Francisco Bay National Wildlife Refuge – a major wildlife and bird sanctuary. • Crosses multiple marshlands, seasonal wetland, rivers					• Lower impact anticipated		
	• Highest number of water crossings • Long length of sensitive habitat							
	• Highest length of floodplain							
Minimize Impacts to Social and Economic Resources	○	◔				●		
	• Minority populations reside along Mulford line in Santa Clara County, along all alignments in central Alameda County, and in southern, western, & central portions of Oakland. With distribution of minorities along all alignments, disproportionate impacts are not anticipated.							
	• Nearly 4,000 meters of farmland of statewide importance length of farmland					• No farmland of statewide importance		
	• Highest length of prime & unique farmlands							
Minimize Impacts to Cultural Resources	TBD							
Maximize Avoidance of Areas with Geologic and Soils Constraints	◕	◑	◔	○	○	●	◑	◔
	• Fault crossings							
	• Silver Creek–3	• Silver Creek—1 • Hayward—2	• Silver Creek—1 • Hayward—3	• Silver Creek—1 & adjacent to Hayward Fault in Fremont	• Silver Creek—1 & adjacent to Hayward Fault for several miles	• Silver Creek—1	• Silver Creek—1 • Hayward Fault—2	• Silver Creek—1 • Hayward Fault—3
	• Generally same levels of erodible, shrink/swell soils							

○ ◔ ◑ ◕ ●
Least Favorable **Most Favorable**

Table S.2-6
Bay Area-to-Merced Corridor -- High-Speed Train Station Attainment of Objectives
San Jose-to-Oakland Segment

OBJECTIVE	STATIONS		
	South Alameda Co.	**Oakland Airport/ Coliseum**	**Oakland**
	Mowry Avenue (I-880 Alignment Only)	**Coliseum BART Station (Mulford/Hayward Alignment Only)**	**West Oakland**
	Auto Mall Parkway (Mulford Alignments Only) **Warm Springs (I-880/Hayward & WPRR Alignments Only)** **OR Union City (I-880/Hayward & WPRR Alignments Only)**	**Coliseum BART Station (Mulford/Hayward/WPRR Alignment Only)** **I-880/Hagenberger Rd. (I-880 Alignment Only)**	**Lake Merritt** **12th/City Center** **Jack London Square**
Maximize Ridership/Revenue Potential	◕	◑	●
	• 808,533 employment • 462,395 population	• 593,747 employment • 250,185 population	• 2,565,241 employment • 1,244,401 population Assumes station in downtown San Francisco
Maximize Connectivity and Accessibility	◑	●	●
	●	●	
	●	◕	
	●		
	• I-880 Freeway	• BART • Capital commuter rail • AC Transit buses • Connector to Oakland Airport	• BART • AC Transit buses
	• I-880 Freeway (1.5 mi.) • Capitol commuter rail • ACE commuter rail • AC Transit buses	• BART • Capital commuter rail • AC Transit buses • Connector to Oakland Airport	• BART • AC Transit buses
	• BART • AC Transit buses	• AC Transit buses • Connector to Oakland Airport	• BART • AC Transit buses
	• BART • Capital commuter rail • AC Transit buses		• Amtrak • Capitol commuter rail • AC transit buses
Minimize Operating and Capital Costs	●	●	◕
	• No operational issues	• Potential joint use by rail transit providers	• All terminal stations designed as two track terminals. All can be expanded to four tracks.
		• Potential joint use by rail transit providers • None for I-880 and WPRR	
		• None apparent at this time	

OBJECTIVE	STATIONS		
	South Alameda Co.	**Oakland Airport/ Coliseum**	**Oakland**
	Mowry Avenue (I-880 Alignment Only)	**Coliseum BART Station (Mulford/Hayward Alignment Only)**	**West Oakland**
	Auto Mall Parkway (Mulford Alignments Only)	**Coliseum BART Station (Mulford/Hayward/WPRR Alignment Only)**	**Lake Merritt**
	Warm Springs (I-880/Hayward & WPRR Alignments Only) **OR Union City (I-880/Hayward & WPRR Alignments Only)**	**I-880/Hagenberger Rd. (I-880 Alignment Only)**	**12th/City Center**
			Jack London Square
Maximize Compatibility with Existing and Planned Development	●	●	◑ ◑ ● ●
	• Compatible land uses		• Adjacent to BART in mixed-use area, including residential, commercial & light industrial • Underground in mixed use area, including residential & commercial • In highly developed commercial area – compatible • Below existing train terminal – compatible
Minimize Impacts to Natural Resources	● ◑ ● ●	●	
	• The Mulford Station is adjacent to the Wildlife Refuge. • All other stations have no known impact	• No impact to natural resources	
Minimize Impacts to Social and Economic Resources	●	● ● ◑	◑ ◑ ● ●
	• Mowry Avenue Station is closest to residential areas • Minimal impact	• The station for the WPRR alignment is closest to the minority housing development. • Mulford line in commercial area • I-880 station in commercial/ highway area	• West Oakland & Lake Merritt have greatest minority population adjacent to station • City Center & Jack London Square more commercial in Nature
Minimize Impacts to Cultural Resources	●		
	• No stations near known cultural resources – no affirmative survey performed		

OBJECTIVE	STATIONS		
	South Alameda Co.	**Oakland Airport/ Coliseum**	**Oakland**
	Mowry Avenue (I-880 Alignment Only)	**Coliseum BART Station (Mulford/Hayward Alignment Only)**	**West Oakland**
	Auto Mall Parkway (Mulford Alignments Only)	**Coliseum BART Station (Mulford/Hayward/WPRR Alignment Only)**	**Lake Merritt**
	Warm Springs (I-880/Hayward & WPRR Alignments Only) **OR Union City (I-880/Hayward & WPRR Alignments Only)**	**I-880/Hagenberger Rd. (I-880 Alignment Only)**	**12th/City Center** **Jack London Square**
Maximize Avoidance of Areas with Geologic and Soils Constraints	●	●	●
	●		●
	◕		●
	●		◔
	• All stations will be designed to withstand the anticipated seismic event		
	• The Warm Springs Station is closest to the Hayward fault.	• All of the stations are in similar geologic conditions	• Jack London Square Station would have the most difficult soil conditions

○ ◔ ◑ ◕ ●
Least Favorable **Most Favorable**